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INSTALLATION, OPERATIONS, AND MAINTENANCE MANUAL

Nasometer II
Model 6400

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Chapter 1 - Introduction

Program Overview

The Nasometer is used worldwide in the assessment and treatment of patients with cleft palate, motor speech disorders, hearing impairment, and functional nasality problems. Developed by Drs. Samuel Fletcher, Larry Adams, and Martin McCutcheon at the University of Alabama at Birmingham, Biocommunications Department, the Nasometer is a practical, computer-assisted instrument, based on years of research and comprehensive clinical testing.

Nasality is an aspect of voice "quality" traditionally assessed by the perceptions of professionals involved in the evaluation and treatment of resonance disorders. However, despite the importance of an expert's perception of the absence, or presence and degree, of nasality to the evaluation process, there is also a need for objective measurement. This is particularly true regarding the effects of maxillofacial surgery, prosthetic fitting, and the therapeutic process. In fact, clinics equipped for assessment alone are often unable to carry over an objective analysis of velopharyngeal function into the clinical treatment realm.

Since its introduction in 1987, the Nasometer has provided an easy, non-invasive method for assessing nasality objectively. And studies have shown that regardless of the language spoken, a high correlation exists between perceived nasality (using experienced clinicians) and Nasometer scores.

The nasality measure is derived from the ratio of acoustic energy output from the nasal and oral cavities of the speaker. Using an innovative input device consisting of a directional microphone mounted on either side of an efficient sound separator plate (with 25 dB separation between channels), the Nasometer headset facilitates accurate signal analysis, which ultimately yields a "nasalance" score. As the speech signal enters the system, the ratio of the nasal acoustic energy to the oral plus nasal acoustic energy is calculated in terms of percentage (i.e., $(N/(N + O)) \times 100 =$ Nasalance) and is displayed graphically on the host computer screen in real time.

As nasality increases, the nasalance contour rises toward the top of the data view screen, or the 100% nasalance level. As nasality decreases, the trace remains at the bottom of the data view screen, towards the 0% nasalance level. Subtle changes in the degree of nasality are reflected in the nasalance percentage. Note that 0% and 100% scores are never obtained during speech because the acoustic separation provided by the plate on which the microphones are mounted is not infinite. The 25 dB separation is adequate for the instrument's purpose, but there is some "spillover" between channels; hence a sustained "ah" may, for example, show 10% nasalance rather than 0%.

The Nasometer II can be used for assessment purposes, by analyzing nasalance on standardized reading passages over time for up to 100 seconds. Measures such as mean nasalance, maximum and minimum nasalance, and more, can be instantly calculated. Statistics, which can be stored or printed out on paper, reflect the production of standardized reading passages and can be compared to normative data on subjects within the patient's age group. Also, the graphic display, or nasogram, is instructive in that it reflects the patient's nasalance pattern for this particular passage. Such normative data continue to be gathered by users of the Nasometer around the world.

As for the treatment process, the Nasometer II provides tangible goals for patient guidance. These targets can be set visually according to the stimulus chosen and the capability of the patient. If a patient's velopharyngeal mechanism is anatomically and physiologically capable of normal functioning, he can learn to monitor and improve velopharyngeal control by gauging his performance through visual biofeedback.

Normative Data on Nasometer II (software version 2.6 and higher)

Normative data on 40 adults (20 males, 20 females) has been collected using the Nasometer II on the Zoo Passage, Rainbow Passage, and Nasal Sentences. Normative data on the SNAP Test (for preliterate children) will be conducted at a later time and will be published on the Kay Web site upon completion (www.kayelemetrics.com).

The normative data obtained on Nasometer II varies somewhat from data reported on the original Nasometer. Nasometer II uses the same headset and rationale for computing nasalance scores, however, the analog and digital circuitry in Nasometer II, while similar, is not identical to the analog circuitry of the original Nasometer.

It should also be noted that the normative data in this manual was obtained on software version 2.6. The Nasometer II external hardware module contains internal filter switches which need to be set to the appropriate position so to ensure your system is set the same as that used for the normative data supplied in this manual. (In **Appendix A - Installation and Setup** of this manual, see instructions on making this switch adjustment. This only pertains to customers who received their Nasometer II prior to March 2003).

Data collected on Nasometer II before installation of the version 2.6 (and adjusted Nasometer II hardware setting) should not be compared in a strict way to normative data on Nasometer II published in this manual. Kay apologizes for any inconvenience, but the company feels strongly that the new software/hardware configuration results in improved system operation.

Users familiar with Nasometer II software prior to the release of version 2.6 will note that playback of speech output is now filtered resulting in somewhat reduced fidelity from what they may be accustomed to with prior software. However, the occasional ambiguity of input gain setting has been largely resolved with the filter in place, and is thus considered more important than the somewhat reduced playback fidelity of the speech signal.

Installation of Sound Card, Hardware, and Software

These topics are covered in **Appendix A – Installation and Setup**.

Importance of Using the Supplied Sound Card

The Nasometer II is supplied with a particular sound card which should be installed in your computer along with the sound card's software. System performance cannot be guaranteed with other sound cards. Given the variability in sound card performance and specifications, instructions as well as normative data provided in this manual may not apply if other sound cards are used. See **Appendix A – Installation and Setup** for instructions on installing the sound card.

Caution on Using the Nasometer II with Laptop Computers

Using the same rationale as above, after running tests with a number of laptop computers (with sound cards installed), Kay does not recommend using Nasometer II with laptop computers unless they are only to serve as visual feedback (as opposed to assessment) devices. The reason, again, is due to the wide variability of sound card performance and specifications in laptops.

Chapter 2 – Getting Started

Nasometer II External Module Connections

The Nasometer II is easy to assemble once software has been installed.

To connect the Nasometer II system, proceed as follows:

1. Place the Nasometer II external hardware box next to your host computer. Connect the power supply connector to the DC Input jack on the back of the external box and plug in the line cord to a power outlet.

2. Connect the Nasometer II headset connector to the Headset Input jack on the front of the Nasometer II external hardware box.

3. Connect the Y-cable to the front of the Nasometer II external hardware box, with the red-ended cable connected to the Oral (channel 2) output jack and the gray-ended cable connected to the Nasal (channel 1) output jack. Connect the other end of the Y-cable to the Line-level input of the sound card which you have installed in your computer (see **Appendix A – Installation and Setup** for sound card installation instructions). This input is the blue connector on the sound card.

Sound Card and External Hardware Settings

Sound Card Settings

The Nasometer II program is designed for use with the supplied multimedia sound card. The sound card must be properly configured for data collection. After installation of the sound card software, make sure that the **Record Source** is set to **Line In**. The sound card software input gain which is found under **Record Setting** should be set to the Maximum level (move slider to the top position). The Pan L/R slider should be left alone in the middle position. Note that these settings are found in the sound card software (not the Nasometer II software). See **Appendix A – Installation and Setup** for detailed information on sound card installation.

External Hardware Settings

When using the Nasometer II as an assessment tool (i.e., having patient read one of the standardized reading passages for comparison to normative data), the clinician should set the Gain setting of the external module to the Min position (lowest notch position). It is important to use this setting because normative data was collected using it; this particular setting has been found to be appropriate across an extensive variety of vocal amplitudes used in conversational speech. Using this setting should result in minimal peak clipping (VU meter peaking in the red area during speech input) and minimal data dropouts (portions of data not detected during speech input). During speech input, the Nasometer II VU meter should peak in the green/yellow regions using this setting. Using other notch settings for assessment purposes is discouraged. If you experience problems using this setting, please contact the factory.

When using Nasometer II for visual feedback, the Gain setting can be adjusted for softer voices by increasing the Gain setting on the Nasometer II hardware box.

Loading the Nasometer Program to Begin Using System

After installing Nasometer II software (see **Appendix A – Installation and Setup** for instructions), you can boot the Nasometer II program by double-clicking on the Nasometer II icon placed on your desktop during the installation process. Once the software is loaded, the first thing you should do is calibrate the Nasometer headset.

Calibrating the Nasometer II Headset Microphones

Calibration of the Nasometer II headset microphones is necessary for accurate data collection and analysis. The Nasometer II software must be running to perform calibration. To calibrate the headset microphones, proceed as follows:

Mounting the Headset in Calibration Bracket

1. Insert the Nasometer II headset into the bracket on the top of the Nasometer II external hardware box. The headset sits vertically in the mounting bracket with the microphones facing the speaker. Only one side of the headset plate contains a notch; this side should be slid into place with notch inserted into horizontal post in calibration bracket.

2. Minimize the effect of sound reflections (from the calibration tone) during the calibration procedure. To do this, the headset's harness and headband should be oriented directly behind, and as far away as possible from, the microphones during calibration to minimize reflections (see picture below for proper orientation of the headset in the calibration bracket and position of the harness). The calibration stand itself should be at least a foot (30 cm) from the wall or other solid objects and ideally placed in the center of tabletop (as opposed to the edge of the table). See figure below for proper headset placement.

3. The headset cable connector is plugged into the Headset Input jack on the front panel of the Nasometer II box.

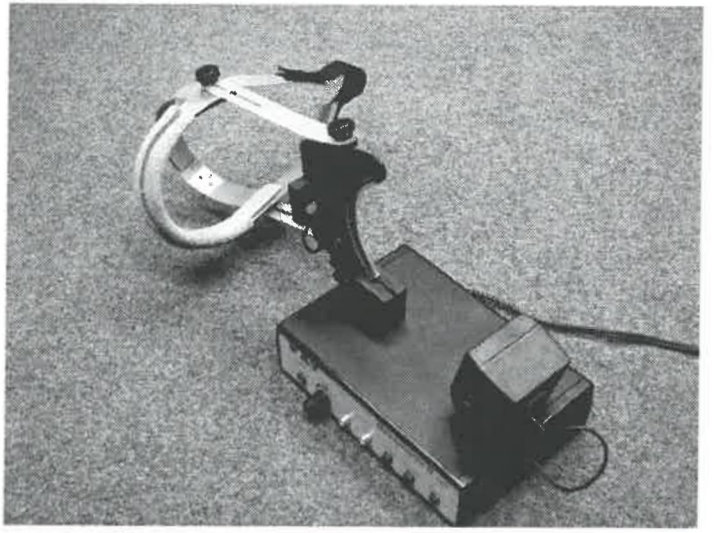


Figure 2.1: Note proper orientation of headset in the calibration stand. The headband should be positioned in back of, and maximally away from, the microphones to avoid potential reflection effects during calibration.

Calibration Procedure

1. The headset is placed in the calibration bracket as described above.

2. Make sure the Line input gain for your sound card is set to Maximum.

3. Turn the external Nasometer II box on pressing the power button.

4. Make sure Gain on the Nasometer II hardware module is set to the Min position.

5. From the Nasometer II software application window, click the Options menu, then **Calibrate Nasometer Headset**. A blue progress meter is displayed in the application window status bar, and a message box reports "Calibrating Nasometer input audio...".

6. Press Calibrate button on the Nasometer II external hardware box.

7. A series of pulses is produced and directed from the speaker on the Nasometer II hardware box toward the Nasometer II headset that is mounted in the hardware box.

8. After a short time, an Audio Calibration message box is displayed, reporting the new calibration value. Typical values are in the range 0.9 to 1.1.

9. Press Calibrate on the Nasometer II hardware box to shut the pulses off.

10. In the Audio Calibration message box, click OK to close the dialog box.

11. When the calibration value is saved, it is written to the computer registry file, where it is accessed by the Nasometer II program each time it is run.

Possible Error Messages During Calibration

If there are problems during calibration, a red error message will appear in the message box on screen with one of the following messages:

OVERDRIVEN	The signal amplitude is above the set overflow value.
SIGNAL LOW	The signal has insufficient strength.
BACKGROUND NOISE	The signal does not have the expected characteristic of the calibration pulses (i.e., period of silence between pulses is less than 100 msec).
BAD SIGNAL	The signal does not have the expected characteristic of the calibration pulses (i.e., period of silence between pulses is greater than 200 msec).
SYNCHRONIZATION	The pulse in one microphone is not timed with the other microphone.
BALANCE	The energy ratio between Channel 1 (nasal) and Channel 2 (oral) is less than 1:2 or greater than 2:1. Contact the factory if this error message appears.

Make sure hardware is set up and properly positioned and that ambient noise levels in room are kept to a minimum during calibration. Consult factory if you have taken these precautions and still obtain an error message during calibration.

Positioning the Nasometer II Headset on the Subject

The Nasometer II headset is designed to provide uniform means of data collection. Great care should be taken when adjusting the headset to a patient because incorrect placement can affect nasalance values.

The lightweight headset is made up of a harness that holds a nasal/oral separation plate and two microphones. The directional microphones mounted on either side of the separation plate collect the separated nasal and oral acoustic signals. The separation plate provides about 25 dB separation between the nasal and oral signals. A supply of plastic (polyurethane) tubing seals is provided to slide over the separation plate's edge; the seal will be in direct contact with the patient's upper lip. These seals should always be used for patient comfort.

The Nasometer II headset is used in direct contact with the patient. Therefore, standard care and procedures should be observed by the user to ensure safe use.

Placing the Headset on a Patient

Refer to the side view and front view figures below, which illustrate the proper placement of the headset on a patient.

The headset should be placed over the patient's head and then be adjusted using the band that rests on top of the head and the Velcro strip in back. The two upper adjustment knobs should be adjusted for appropriate length. Adjustments must be made so that the separation plate stays securely in contact with the area between the nose and upper lip (there should be no gap). The angle of the separation plate should always be as perpendicular as possible to the frontal plane, or face; it is adjustable using the two lower knobs.

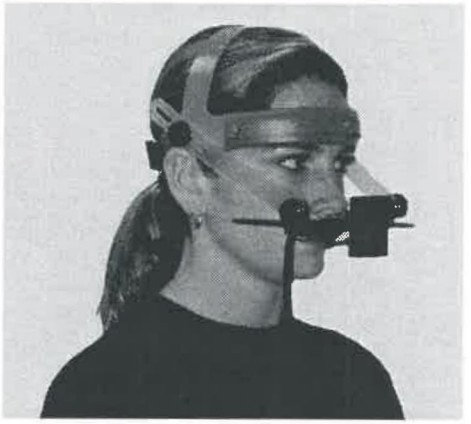
It is important that the separation plate never be placed at excessive upward or downward angles against the face when collecting data. An angle in excess of 15 degrees from perpendicularity (i.e., 90 ± 15) in either direction will result in inaccurate data collection.

With the headset in place, the user is ready to begin assessment or treatment.

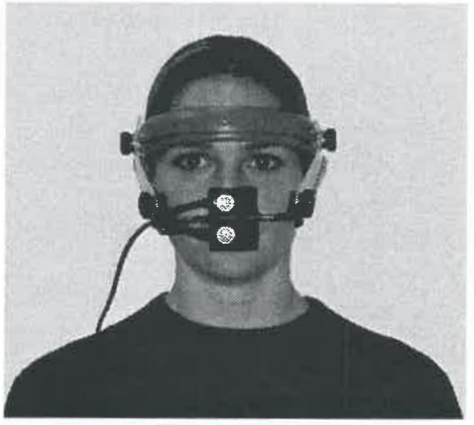
Placing the Headset on Young Children

The Nasometer II has been used with children as young as three years of age. Placing the headgear on very young children may require a period of desensitization. Some clinicians have reported success using other types of headgear (e.g., hats, helmets, etc.) in play therapy prior to putting the Nasometer II headgear on the child. Most importantly, the clinician should be adept at placing the headgear on the child as quickly as possible.

Proper Placement of the Headset - Side View



Proper Placement of the Headset - Front View



Nasometer II Headset Standard Care and Procedures

The Nasometer II was designed to be non-invasive: no direct contact with the inside of the mouth or nose of the patient is required. However, because water vapor from the mouth and nose will condense on the separation plate, the user is advised to disinfect the separation plate and change the disposable plastic seal between patients, or as required. The antimicrobial towelettes provided with the Nasometer II can be used to wipe the separation plate and the plastic seals, but do not wipe the microphones themselves as you may risk damaging them. To obtain towelettes, contact TEXWIPE at the address below. Note that this particular product is not the only type of towelette available. For further information or advice, contact your facility's Department of Infection Control.

The Texwipe Company LLC
650 East Crescent Avenue
Upper Saddle River, New Jersey 07458-0308
Telephone: 201-327-9100, Toll Free: (800)-TEXWIPE, ext 120 (839-9473)
Fax: 201-327-5945

To ensure reliable data collection over time, Kay recommends that the Nasometer headsets be returned to the factory yearly to check for microphone sensitivity and frequency response changes. See **Appendix B – Maintenance Recommendations** section in this manual.

Program Startup

After starting the Nasometer II program, the Nasometer II application window should look similar to the following image below. The application window is made up of a stimulus display window and a Nasometer II data window.

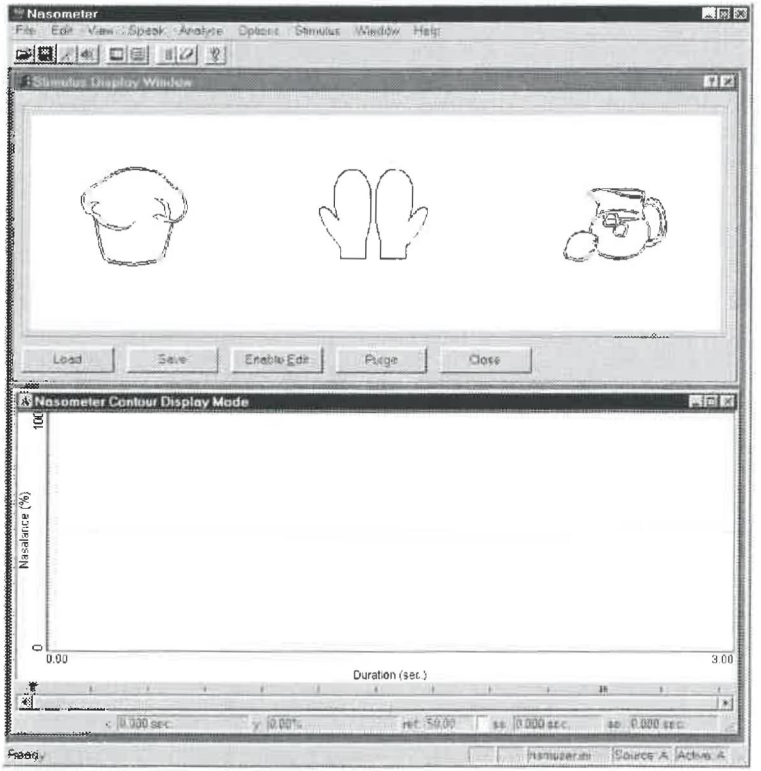
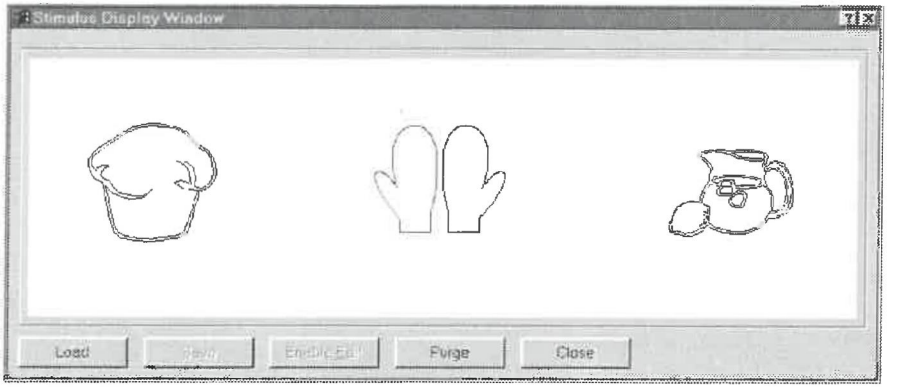


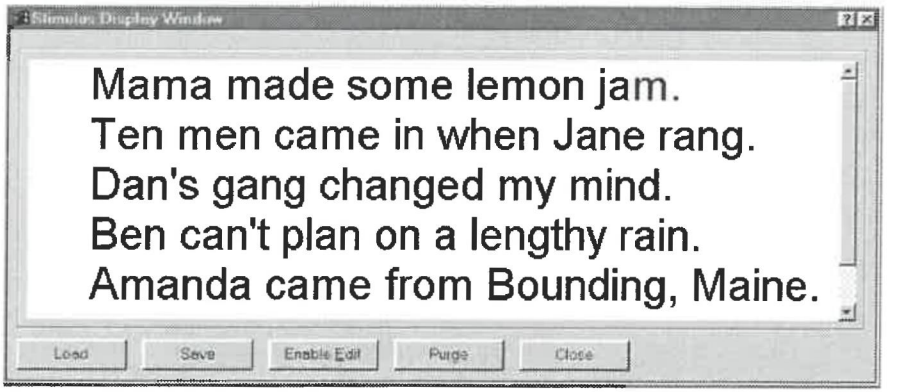
Figure 2.1: The Nasometer II application screen is shown above with a stimulus display window on top and a data window below.

Stimulus Data Window with Loaded Stimulus File

Below are images of the stimulus display window with a Picture Stimulus File loaded and with a Text Stimulus File loaded. The Stimulus File display area displays either a short reading passage; a group on monosyllables, sentences or phrases entered by the examiner; or a series of pictures that serve to cue the patient. The Nasometer II program provides a selection of reading passages which can be used to observe nasalance during running speech. In addition, the user can create and store customer stimulus files for use during assessment or treatment sessions. Picture stimuli, which are particularly useful for preliterate patients or patients with low reading skills, are also provided.



Picture Stimulus File



Text Stimulus File

Setting the Nasometer II Options

There are a number of Nasometer II analysis and display parameters that may be set by the user. To set the Nasometer II options, proceed as follows:

1. All parameters may be set from within the Nasometer II Setup dialog box. To display this box, access the **Options** menu and click on the **Select Nasometer Options** menu item.

2. The Nasometer Setup box contains four separate tabs. Click on the appropriate tab for the options you want to set, then set the desired parameters. Descriptions of options in each tab can be found by selecting a tab name below:

   Analysis - capture and processing options
   Display - display options
   Reference - reference cursor location and timer light settings
   Playback - audio output options

3. After changing the settings, click APPLY to apply the new settings to the active Nasometer II window. Click OK to close the dialog box and save the modified parameters for the session without applying the new settings to the current window. For these parameters to take effect, they must be saved in the user initialization file, where they will be applied during the next session. Click CANCEL to close the dialog box and discard any changes that were made and not yet applied.

Capturing and Processing Nasometer II Data

You may record and analyze oral and nasal signal data, and display in real time the nasalance results in the active window. To capture data, proceed as follows:

1. The Nasometer II headset must be calibrated before first use, and at periodic intervals thereafter.

2. Ensure that the headset is correctly connected to your data acquisition hardware, and that the recording level settings are correct.

3. The Nasometer II headset must be properly positioned on the client.

4. To view and set the Nasometer II analysis and display options for the active window, choose **Select Nasometer Options** from the **Options** menu.

5. To begin real-time capture and processing, press the F12 key. Assuming you are using the default Contour Display mode, if you sustain a phoneme such as /a/, you should observe a blue line of data towards the bottom of the screen indicating a relative low nasalance reading for this non-nasal phoneme. If you sustain the phoneme/m/, data will appear towards the top of the screen (high nasalance). Percentages of nasalance are displayed from 0 – 100% on the vertical axis of the screen. Now try some phoneme combinations such as /pa pa/ followed by /ma ma/ and observe differences in the nasalance traces. Then try running speech and observe patterns of nasal resonance as displayed by the Nasometer II in response to your speech output.

6. You may stop data collection by pressing the SPACEBAR; you may then resume by pressing F12 again. Data will be appended to previously acquired data (unless "Data Append" checkbox under Options is unchecked). Otherwise, always press the F2 key to delete all data prior to beginning new data collection, otherwise data will be appended to existing data (this will affect both the display and statistical results). If you wish to obtain an average score of nasalance data for a sentence or group of sentences, stop data acquisition by pressing the SPACEBAR, then click **Analyze** on the menu, then **Compute Statistic Results**. Review the reported results.

Experiment with the instrument in this fashion if you are new to nasometry to gain familiarity with the display and how data is analyzed. Then proceed with further information presented below:

1. During recording, both channels are passed through a filter to limit bandwidth of the signals being processed for nasalance analysis.

2. Real-time capture and processing is indicated by the display of two VU meters in the active window status bar, one above the other. The top meter reports the nasal energy and the bottom meter reports the oral energy. These meters should show green/yellow most of the time during signal input, with higher volume peaks being indicated by yellow. VU meter levels that are becoming too high (overdriven) are shown as red. Depending on the setting for the Nasometer II display mode, a nasalance contour or bar graph may also be displayed in the window in real time, or the window may remain blank.

3. In Contour or Bar display mode, a reference cursor remains displayed in the window at the set nasalance ratio location during data capture. This can be used as a visual target in therapy (e.g., instruct client to "try to stay below this line while you read the following sentences").

4. Once you record past the set capture duration, the oral and nasal data buffers begin to overwrite so that only the most recently acquired data are kept in memory when capture is halted. Press SPACEBAR, ENTER or ESC to stop recording. Alternatively, you may set the program for single-pass operation. In this case, capture is halted automatically once the data buffers are full. Note that the capture duration is set independently of the duration of data displayed in the window.

5. If the window display duration is less than the capture duration, the full length of data can still be recorded. However, once data capture is halted, only the last part of the data will appear in the window when it is set for Contour display mode. The nasalance value of the last frame of data captured is displayed when in Bar display mode. In either of these display modes, use the scroll bar below the display to view earlier portions of the data.

6. You may optionally change display modes, and examine the captured Nasometer II data in each mode.

7. The numerical results and statistics may be computed and displayed.

8. Listen to the captured Nasometer II data by selecting **Speak All** from the **Speak** menu. In Contour display mode, you may optionally select a smaller range of data for audio playback. Depending on the setting for the Nasometer II display mode, a nasalance contour or bar graph may be re-displayed in the window during playback. Note that speech played back in software versions 2.6 (and higher) is filtered, which affects sound quality, but the speech signal is intelligible.

Displaying Nasometer II Statistics

The program provides facilities to display, and optionally print, save, or export to a spreadsheet, the raw nasalance data. The statistics pertain to the selected range of data in the active window when in Contour display mode. To produce results statistics, proceed as follows:

1. Data must be present in the Nasometer II data window. This data may be obtained using the record, analyze, or load routines.

2. By default, all of the data are initially selected (blue selection cursors are at start and end of the data screen). When in Contour display mode, you may optionally select a smaller range of the data to view or export. To select a subsection of data, press Shift+Left mouse button to select data. The two blue vertical selection cursors can be placed around any subsection of data desired for analysis.

3. To display statistics for nasalance results in the Nasometer II data window, select **Compute Result Statistics** from the **Analyze** menu. The default software setting is for the entire buffer of data to be analyzed (i.e., data that is displayed on the screen and off the screen).

A Nasometer II Statistics box appears in the work area displaying the statistics. You have the option of saving the statistics in a file or sending the results to a printer (see below). Close the dialog box by clicking OK. To save result statistics to a text file, proceed as follows:

1. With the statistics displayed, click SAVE AS in the Nasometer II Statistics box. A Save As box is displayed in the work area.

2. Scroll to the location where you wish to save the file, and enter a file name in the File Name box. If not included with the filename, an OUT file extension is appended to the entered name when the file is saved.

3. Choose how the columns of information will be separated when the data are saved to disk storage. The field separator may be a space, a tab, or a comma. Choose the TAB or COMMA option to format the file for access by a spreadsheet program. Select the SPACE option to save the file so that the display is easily read when you send it to the printer or if you intend to edit it at a later date using any standard text editor.

4. In the Contents section, select the information you wish to save in the file. This may include both statistics and numerical results.

5. Once you have entered the filename, and have selected the information you wish to save and the column separator, click SAVE to continue with the save operation. Click CANCEL to close the Save As box without saving the data.

6. After you click SAVE, a Nasometer II Header Information box is displayed. You may enter Patient Identification information in the provided spaces, including institution name, patient name, case number, and a comment. Fields for date and stimulus file are automatically filled in, but may be modified. Click OK to include this header information at the top of the file being saved. Click SKIP to save the file without the header information. Click CANCEL to return to the Save As box.

To print result statistics, proceed as follows:

1. With the result statistics displayed, click PRINT in the Nasometer II Statistics box. A Nasometer II Print Setup box is displayed in the work area.

2. In the Margins section, you may enter header and/or footer information, including text, the current time (%t), current date (%d), and page numbers (%p). In the Contents section, select the information you wish to print. This may include parameter information, statistics, and numerical results.

3. In the Contents section, select the information you wish to print. This may include both statistics and numerical results.

4. Click SETUP to select the default printer and access other printing options for the selected printer. Click FONT to select the font to use, font size, etc.

5. Once you have selected the information you wish to print, including any desired header or footer, and set the print variables, click PRINT in the Nasometer II Print Setup box to continue the print operation.

6. A Nasometer II Header Information box is displayed next. You may enter Patient Identification information in the provided spaces, including institution name, patient name, case number, and a comment. Fields for date and stimulus file are automatically filled in, but may be modified. Click OK to print this header information at the top of the page being printed. Click SKIP to print the data without the header information. Click CANCEL to return to the Nasometer II Print Setup box.

Description of Statistics

A number of statistics may be computed and displayed. A brief description of each statistic is provided below.

Statistic	Description
Mean (%)	The mean nasalance of the data.
Min (%)	The lowest, or minimum, nasalance value in the data (excluding zero values).
Max (%)	The highest, or maximum, nasalance value in the data.
Start (%)	The nasalance ratio at the start of the data.
End (%)	The nasalance ratio at the end of the data.
Slope	The slope between the start and end of the selected region of data. This statistic is used to examine the rate of velopharyngeal closure. Note that slope is only calculated when the Nasometer II data window is set to Contour display mode, and is never calculated when the selection cursors are further than 500 msec apart.
Time Range (sec)	The difference, in seconds, between the start and end of the data used for statistical analysis. Note that statistics are derived from the selected data only.
Start (sec)	The starting time location, in seconds, of the data used for the statistical analysis. Note that statistics are derived from the selected data only.
End (sec)	The ending time location, in seconds, of the data used for the statistical analysis. Note that statistics are derived from the selected data only.
Oral Over (sec)	The length of time, in seconds, that the oral microphone was overdriven during data recording.
Nasal Over (sec)	The length of time, in seconds, that the nasal microphone was overdriven during data recording.
Threshold (%)	The location of the reference cursor on the nasalance axis. The assigned target nasalance value is valid in all three display modes, although the reference cursor will not be displayed in Empty mode.
Above (%)	The percentage of the nasalance trace that is greater than the ratio value set by the location of the reference cursor.
Below (%)	The percentage of the nasalance trace that is less than the ratio value set by the location of the reference cursor.

Displaying Numerical Results

You may display, and optionally print and save, the numerical results associated with the nasalance data in the Nasometer II data window. To display numerical results, proceed as follows:

1. Data must be present in the Nasometer II data window. This data may be obtained using the record, analyze, or load routines.

2. To display numerical results for all nasalance results in the Nasometer II data window, select **Produce Numerical Results** from the **Analyze** menu.

3. A Nasometer II Analysis Results dialog box appears in the work area displaying the numerical results. You may scroll through the results using the mouse or the cursor control keys.

You have the option of saving the results in a file or sending the results to a printer (see below). Close the numerical results box by clicking DONE. To save numerical results, proceed as follows:

1. With the numerical results displayed, click SAVE AS in the Nasometer II Analysis Results box. A Save As box is displayed in the work area.

2. Select the correct drive and directory location, and enter a file name in the File Name box. If not included with the filename, an OUT file extension is appended to the entered name when the file is saved.

3. Choose how the columns of information will be separated when the result file is saved to disk storage. The field separator may be a space, a tab, or a comma. Choose the TAB or COMMA option to format the file for access by a spreadsheet program. Select the SPACE option to save the file so that the display is easily read when you send it to the printer or if you intend to edit it at a later date using any standard text editor.

4. In the Contents section, select the information you wish to save in the file. This may include both statistics and numerical results.

5. Once you have entered the filename, and have selected the information you wish to save and the column separator, click SAVE to continue with the save operation. Click CANCEL to close the Save Results box without saving the data.

6. After you click SAVE, a Nasometer II Header Information box is displayed. You may enter Patient Identification information in the provided spaces, including institution name, patient name, case number, and a comment. Fields for date and stimulus file are automatically filled in, but may be modified. Click OK to include this header information at the top of the file being saved. Click SKIP to save the file without the header information. Click CANCEL to return to the Save As box.

To print numerical results, proceed as follows:

1. With the numerical results displayed, click PRINT in the Nasometer II Analysis Results box. A Nasometer II Print Setup box is displayed in the work area.

2. In the Margins section, you may enter header and/or footer information, including text, the current time (%t), current date (%d), and page numbers (%p). Click the Header and/or Footer check box, and enter the desired information in the corresponding edit box.

3. In the Contents section, select the information you wish to print. This may include both statistics and numerical results.

4. Click SETUP to select the default printer and access other printing options for the selected printer. Click FONT to select the font to use, font size, etc.

5. Once you have selected the information you wish to print, including any desired header or footer, and set the print variables, click PRINT in the Nasometer II Print Setup box to continue the print operation.

6. A Nasometer II Header Information box is displayed next. You may enter Patient Identification information in the provides spaces, including institution name, patient name and case number, the date, and a comment. Click OK to print this header information at the top of the page being printed. Click SKIP to print the data without the header information. Click CANCEL to return to the Nasometer II Print Setup box.

Chapter 3 - Operations

Modes of Data Capture

Nasalance results may be displayed as a contour measuring nasality on a time line, or as a bar graph for an individual frame of data, or the data may be collected but hidden. These three options are referred to as Contour, Bar, and Empty display modes, respectively. Note that the information necessary for the calculation of each mode is gathered simultaneously when data are recorded, when an existing audio file is analyzed, or when results are loaded from a file. Thus, it is possible to switch between display modes once results have been obtained.

Additionally, in Bar display mode, or in Contour mode when less than the total length of data is displayed, the "thumb" in the scroll bar below the data shows the current location of the data being displayed. This thumb can be used to move through the data. In Contour mode, you can display a different range of the data by adjusting the size of the scroll bar thumb or by selecting an appropriate item from the View menu.

A description of each of the display modes is given below. You may also view screen capture images of nasalance data in the Nasometer II display window in the three display modes.

Contour Display Mode

1. In Contour display mode, time is represented on the horizontal axis, from left to right. The nasalance ratio (in percentage) is represented on the vertical axis, normally from bottom to top (e.g., 0% at the bottom and 100% at the top). The window title reports "Nasometer Contour Display Mode" (see Figure 3.1).

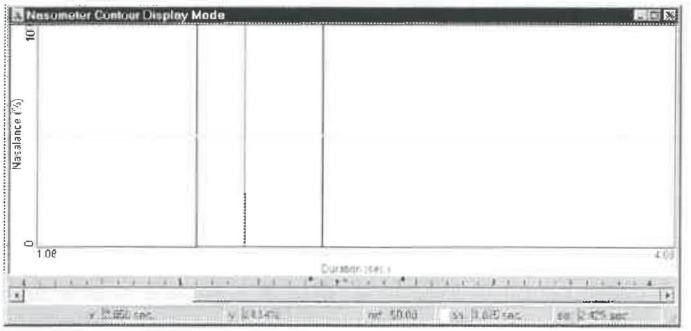


Figure 3.1: Figure shows captured data in Contour Display mode.

2. A time domain scroll bar is displayed under the horizontal axis, representing the full range of data in the window. Whenever less than the full range of nasalance data is displayed in the window, the thumb in the scroll bar shows the relative location of the currently displayed data. Using the thumb in the scroll bar, you may scroll back and forth through the data while retaining the original display duration. For example, if you view the first second of a 10-second contour display, the thumb on the scroll bar would appear at the left of the scroll bar, and would represent 10% of the total scroll bar length. Click on the thumb and drag it right to a new location, still displaying a 1-second range of the contour.

3. From the **View** menu, you may **Scroll Left** or **Scroll Right** by 10 pixels, or you may **Page Left** or **Page Right**, to see the nasalance contour to the left or right of the currently displayed data.

4. You may select a different range of data to display from the **View** menu. Options are to view **All Data, Selected Data, Start to Cursor,** or **Cursor to End.** Alternatively, you may click on one end of the thumb and move it right or left, increasing or decreasing the length of the thumb, and thereby increasing or decreasing the range of data that is displayed.

5. The contour is redrawn in real time during audio playback of the data. The display may sweep or scroll across the window, depending on the setting for Contour Display Type. In addition, an indicator above the scroll bar moves along during audio output, to show the current location of the data being spoken. This indicator is red, and is shaped like a right-pointing arrowhead.

Data Cursor

In Contour display mode, the red data cursor graphically identifies a specific location in the data. The time (sec) and nasalance (%) values at the current cursor location are reported on the window status line in the x-axis and y-axis boxes, respectively. You may click on the data cursor and, holding the LEFT mouse button down, drag it to a new location in the data.

Bar Display Mode

Bar mode is very intuitive for single phoneme exercises, or for explaining basic concepts. For example, sustain an "ah" and then an "m", and observe the gross differences in the Bar mode.

1. In Bar display mode, nasalance energy is represented on the x-axis, normally from left to right (e.g., 0% on the left and 100% on the right). There is no representation on the y-axis; however, the time value of the start of the currently displayed nasalance ratio frame is reported in the y-axis box on the window status line. The window title reports "Nasometer Bar Display Mode" (see Figure 3.2).

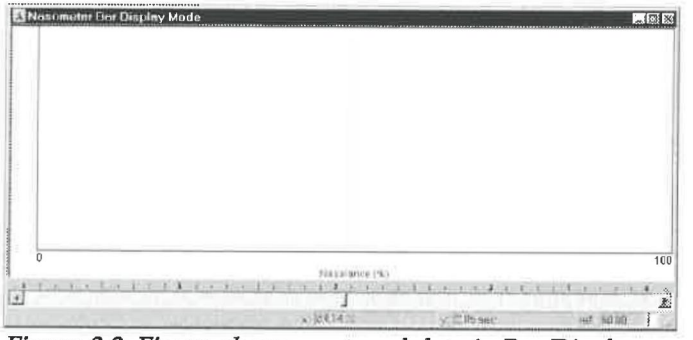


Figure 3.2: Figure shows captured data in Bar Display Mode.

2. A time domain scroll bar is displayed under the horizontal axis, representing the full range of data in the window. The thumb in the scroll bar shows the relative location of the currently displayed frame of data in the window. By clicking on and dragging the thumb in the scroll bar, you may scroll back and forth through the data, displaying the nasalance ratio for previous or following frames.

3. The bar graph will display the nasalance ratio for one frame of data only. The scrolling options in the **View** menu were not intended to be used when the window is set to Bar display mode.

4. The bar graph updates in real time during audio playback of the data. In addition, an indicator above the scroll bar moves along during audio output, to show the current location of the data being spoken. This indicator is red, and is shaped like a right-pointing arrowhead.

Empty Display Mode

1. In Empty display mode, the nasalance display is hidden. The window title reports "Nasometer Blank Display Mode" (see Figure 3.3).

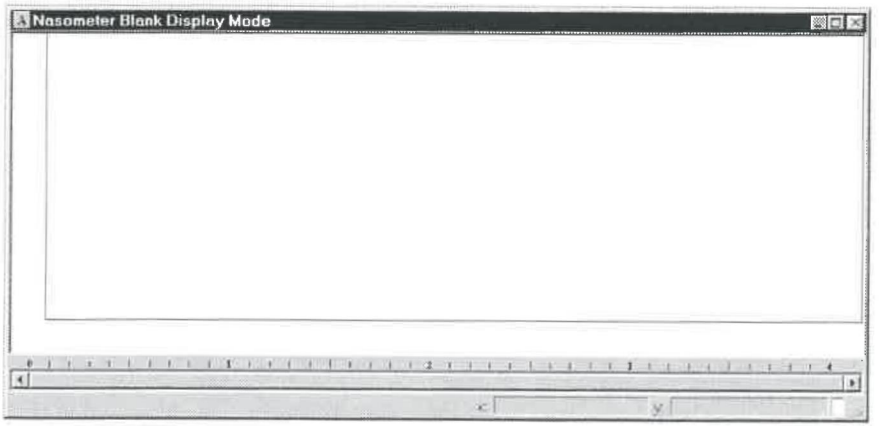


Figure 3.3: In Empty Display Mode, the nasalance display is hidden and the window title reads "Nasometer Blank Display Mode".

2. A time domain scroll bar is displayed under the horizontal axis, representing the full range of data in the window. The thumb in the scroll bar fills the scroll bar. The size and position of the thumb cannot be adjusted.

3. There is no real-time update during audio playback of the data. However, an indicator above the scroll bar moves along during audio output, to show the current location of the data being spoken. This indicator is red, and is shaped like a right-pointing arrowhead.

Select a Region of Data

In Contour display mode, two blue bars are placed in the Nasometer II data window to graphically show the locations of the start and end of the selection area. When nasalance results are first placed in a window, this selection area is defined to be all the data. You may select a smaller region of data in the Nasometer II data window.

Two boxes on the window status bar report the locations of the start of the selection area (ss) and the end of the selection area (se). In addition, two blue indicators above the scroll bar show the relative location of the selection area to the whole of the data.

A number of program operations can be performed using the data in the selection area. For example, statistics are generated for the selected data only. In addition, you may speak or show the selected range of data. To change the selection area, proceed as follows:

1. Note that a range of data may be selected only when the Nasometer II data window is set to Contour display mode from the Nasometer II setup box. In Bar or Empty display mode, a selection area cannot be defined. Any operations performed on the selected data when in these display modes will act on all of the data.

2. To redefine the selected region of data, do <u>one</u> of the following:

   a) To select the currently displayed data, choose **Select Displayed Data** from the **View** menu.

   b) Hold SHIFT down as you click the LEFT mouse button inside the Nasometer II data window. The mouse pointer turns into a double arrow symbol, and a blue bar is placed in the window at the location of the mouse click. Keeping the LEFT mouse button depressed, drag the mouse cursor through the window. A second blue bar is moved through the window as you drag the cursor. When the mouse button is released, the blue bar remains at the location of the cursor. These two bars mark the start and end of the selection area.

   c) Move the mouse pointer to the start or end boundary of the currently defined selection area, represented graphically as a blue bar in the data. The mouse pointer turns into a double arrow symbol when it is over the selection mark. Click the LEFT mouse button and hold it down as you drag the selection mark to a new location. (Note that if the data cursor is at the same location as the selection start or selection end, it has priority over the selection area mark. The click-and-drag operation must be used to move the data cursor away from the selection mark before it can be accessed.)

3. The **ss** (selection start) and **se** (selection end) boxes on the window status bar are updated to reflect the new selection area. The blue indicators above the time-domain scroll bar are also updated to the new locations of the selection start and selection end marks in the data.

4. At any time, you may redefine the selection area to once again include all data in the active window. To do this, choose **Select All Data** from the **View** menu.

5. Listen to the data inside a selected region by choosing **Speak Selected** from the **Speak** menu. To display only the selected region of data in the window, choose **Selected Data** from the **View** menu. Remember that statistics are generated for nasalance results in the selection area only.

Stimulus Files

Using Stimulus Files

A stimulus display window is automatically opened on program start-up. This window can be used to display a short reading passage, groups of monosyllables, sentences or phrases entered by the user, or a series of pictures that will serve to cue the patient.

Five buttons below the display area allow the user to open an existing text or picture stimulus file, close the open stimulus file, edit an existing or create a new text stimulus file, and, optionally, save the file for use during subsequent assessment and treatment sessions; and close the stimulus display window.

The stimulus display window can easily be re-opened if it was previously closed. The size of the font used to display the reading passages can be increased or decreased. To help sustain a child's attention during a Nasometer II evaluation, a selection of graphics rewards are available.

A selection of reading passages is provided with the Nasometer II program that may be used to observe nasalance during running speech. Some clients will be able to read the text stimulus files during the evaluation or therapy session. Others will have to repeat sections of the stimulus passage after the clinician in a phrase-by-phrase fashion. The available reading passages are listed in the following table.

Reading Passage	Stimulus File Name	Reference
Zoo Passage	ZOO.STM	Fletcher 1972
Rainbow Passage	RAINBOW.STM	Fairbanks 1960
Nasal Sentences	NASAL.STM	
Ball Passage	PLAYBALL.STM	Fletcher 1972
Suzy Passage	SUSIE.STM	MacKay and Kummer 1993

Picture stimuli (MacKay and Kummer 1993) are also provided. These files address the need to have materials for pre-school children or for patients with low reading skills.

Picture Group	Stimulus File Name	Images
bilabials	BILABIALS.BMP	book, pie, baby
alveolars	ALVEOLARS.BMP	tire, turtle, teddy bear
velars	VELARS.BMP	cookies, car, cake
sibilants	SIBILANTS.BMP	dress, scissors, horse
nasals	NASALS.BMP	muffin, mittens, lemonade

Please note that the Nasometer II pre-defined keys and the command line cannot be used if the Stimulus Display Window is active. Activate the Nasometer II data window by clicking on its title bar before using these program features.

Types of Stimulus Files

The Nasometer II program can recall stimulus files for presentation during assessment or treatment sessions. The Zoo Passage, the Rainbow Passage, and Nasal Sentences are commonly used passages in English (note that the Zoo Passage and Nasal Sentences have been found to provide the most important assessment information; the Rainbow Passage is also included due to its widespread clinical use, though it is less revealing for nasometric assessment). Other prepared text files (MacKay and Kummer 1993) have now been included with the program, which are particularly easy for young children to read or repeat.

Some clients will be able to read the text stimulus files during the evaluation or therapy session. Others (e.g., preliterate children or neurologically impaired adults) will have to repeat sections of the stimulus passage after the clinician in a phrase-by-phrase fashion. The clinician should instruct the patient to say the phrase and nothing else. Also, the clinician should stop data capture when providing instructions for what to say next (note: press SPACEBAR to temporarily stop data capture to provide instructions, and then F12 to resume data capture which will be appended to the prior data).

Note that the size of the text used to display the reading passage may be increased or decreased. If the text does not all fit into the stimulus display window at one time, change the font size or use the vertical scroll bar which is available at the right. While data are being recorded, you may press the Down arrow key on the keyboard to scroll down the text passage one line at a time. Press Page Down to scroll down by half a page of text at a time. Similarly, Up, and Page Up may be used to scroll back toward the beginning of the reading passage while data are being recorded.

As an alternative to text stimulus files, a variety of picture groupings have also been incorporated into the program as picture stimulus files. These files address the need to have test materials for pre-school children or for those unable to read.

Opening the Stimulus Display Window

The stimulus display window may be re-displayed after it is closed. To open the stimulus display window, proceed as follows:

1. The stimulus display window is opened automatically on program start-up.

2. If the window was subsequently closed, it may be re-displayed by selecting **Open Stimulus Window** from the **Stimulus** menu.

3. The stimulus display window is displayed on the screen, and the most recently opened stimulus file is displayed in the window. If no file was previously opened (e.g., if the window was purged before it was closed), then the display remains blank when the window is re-opened.

Loading a Stimulus File

A selection of reading passages and picture stimulus files are provided with the Nasometer II program. In addition, the user may create and store custom text stimulus files for use during assessment or treatment sessions. Any stored text or picture stimulus file can be loaded into the stimulus display window. To open a text or picture stimulus file, proceed as follows:

1. The stimulus display window is displayed automatically on program start-up. A text or picture stimulus file may be displayed in this window, or the window may initially be blank.

2. Click LOAD in the stimulus display window to open a stimulus file and display the reading passage or pictures in the window.

3. A standard Open dialog box is displayed.

4. Select the type of stimulus file to load (picture or text) from the Files of Type drop-down box. A list of files in the current folder of the selected file type is displayed. If necessary, scroll to a different location containing the desired file to load.

5. Choose a file from the displayed list, then click OPEN to load the selected stimulus file into the stimulus display window. Note that if the selected file does not have the expected file extension for the file type (i.e., BMP for picture files and STM for text files), an error message is displayed and the file is not opened.

6. It is not necessary to close an open stimulus file before opening a new file.

Clearing a Stimulus Display Window

The stimulus display window may be cleared. This is usually done before creating a new text stimulus file. Note that it is not necessary to close the open stimulus file before opening a new file. To clear the stimulus display window, proceed as follows:

1. The stimulus display window is opened automatically on program start-up. A text or picture stimulus file may be displayed in this window, or the window may initially be blank.

2. If a stimulus file is displayed, the stimulus display window may be cleared by clicking PURGE in the window.

Creating or Editing a Text Stimulus File

The user may create and optionally save custom text stimulus files. Any saved stimulus file can subsequently be loaded into the stimulus display window for use during assessment or treatment sessions. To create a new text stimulus file, proceed as follows:

1. The stimulus display window is opened automatically on program start-up. A text or picture stimulus file may be displayed in this window, or the window may initially be blank.

2. Close any open stimulus file by clicking PURGE in the stimulus display window. The ENABLE EDIT button is activated when the window is cleared.

3. To create a new text stimulus file, click ENABLE EDIT. The ENABLE EDIT button changes to DISABLE EDIT when the stimulus display window is in edit mode.

4. A data cursor begins to blink in the upper left-hand corner of the display area in the stimulus display window. Enter the text passage or list of words and phrases using standard word processing techniques.

5. When you have finished entering text, click DISABLE EDIT to exit from edit mode.

6. To save the new text stimulus file, click SAVE. A standard Save As box is displayed, showing the STM files currently saved in the Nasometer II Stimulus folder. If necessary, scroll to a different folder for storing the file. Enter a filename in the File Name box. If not included with the filename, an STM file extension is automatically appended to the entered name when the file is saved. Click SAVE to save the file.

Note that you cannot save files while in edit mode. You must first DISABLE edit mode, then SAVE the file. To edit an existing text stimulus file, proceed as follows:

1. Load the text stimulus file you wish to edit into the stimulus display window. The ENABLE EDIT button is activated when a text stimulus file is opened.

2. To edit the text file, click ENABLE EDIT. ENABLE EDIT changes to DISABLE EDIT when the stimulus display window is in edit mode.

3. A data cursor begins to blink in the upper left-hand corner of the display area in the stimulus display window, at the start of the open text file. Use standard word processing techniques to modify the displayed text.

4. When you have finished editing the text, click DISABLE EDIT to exit from edit mode.

5. To save the edited text stimulus file, click SAVE. A standard Save As box is displayed, showing the STM files currently saved in the Nasometer II-Stimulus folder. If necessary, scroll to a different folder for storing the file. Enter a filename in the File Name box. If not included with the filename, an STM file extension is automatically appended to the entered name when the file is saved. Click SAVE to save the file.

Note that you cannot save files while in edit mode. You must first DISABLE edit mode, then SAVE the file.

Adjusting the Text Stimulus Font Size

The size of the font used to display a reading passage in the stimulus display window may be increased or decreased. To adjust the font size, proceed as follows:

1. The stimulus display window is opened automatically on program start-up. A text or picture stimulus file may be displayed in this window, or the window may initially be blank.

2. If a reading passage is displayed, it may be desirable to make the size of the displayed text larger or smaller. To do this, select **Adjust Text Font Size** from the **Stimulus** menu.

3. A Stimulus Text Font Size box is displayed. Enter a new value between 8 and 72, inclusive, in the Font Size edit box. Click APPLY to apply the new setting to the existing text in the stimulus display window. Note that if a picture stimulus file is open when you change the font size, you will not be able to see the results of the change until a text stimulus file is opened.

4. You may change the value and apply the new font size as many times as you like, until you find a font setting that the client can read comfortably. After selecting a new font size, click OK or CANCEL to close the Stimulus Text Font Size dialog box.

Closing the Stimulus Display Window

It is possible to close the stimulus display window. To close the stimulus display window, proceed as follows:

1. The stimulus display window is opened automatically on program start-up.

2. The window may be closed by clicking CLOSE on the stimulus display window panel.

3. Using the menus, the window may be subsequently re-opened.

Displaying a Graphics Reward

When working with children, you can better keep their interest by rewarding their attempts at vocalization by causing a "sprite" graphic image to flutter across the screen. To display a sprite, proceed as follows:

1. A number of "sprite" images are supplied with the program, including aliens in a flying saucer, an ape with balloons, a cat with balloons, a hummingbird, a helicopter, and a "Noah's Ark" of animals in a hot air balloon.

2. To cause a "sprite" to fly across the screen, select **Display Sprite** from the **Stimulus** menu.

3. One of the available graphic images is randomly selected and travels across the screen, from left to right, in a randomly selected pattern.

Appending to Existing Nasometer II Data

Existing Nasometer II data may be cleared from the active window before new data are recorded. However, the option exists to append newly captured data to the data already held in memory. To append Nasometer II data, proceed as follows:

1. First, record data and display the computed nasalance results in the active Nasometer II data window, or analyze an audio signal file and display the nasalance results. You may not append to nasalance results data that were loaded from a file.

2. Ensure that data appending is turned on. To do this, choose **Select Nasometer Options** from the **Options** menu to display the Nasometer II Setup dialog box, and access the Analysis tab. Ensure that the Data Appending check box is selected. If it was not previously set, click APPLY to apply the new setting to the active window.

3. Also check the settings for Analysis Duration and Single Pass mode. Note that the data capture buffers are set to a maximum size of up to 100 seconds, with the current buffer size reported in the Analysis Duration edit box. When newly recorded data are appended to existing data, it is possible to overwrite the data at the beginning of the capture buffer unless the Single Pass check box is selected. Make any desired changes to the Analysis Duration and Single Pass settings, then click APPLY. After applying the changes to the active window, click OK to close the dialog box.

4. Select **New (Record)** from the **File** menu to begin recording more data. The new data is appended to the existing data.

5. When Nasometer II data are appended, the existing data are not re-analyzed, and silence is not added at the boundary.

Speaking and Re-displaying Nasometer II Data

A useful feature of the program is the ability to redraw the nasalance results in real time during audio playback. To speak and re-display the data, proceed as follows:

1. Signal data must be associated with the Nasometer II results in the active window. Therefore, you can listen to data obtained using the record or analyze routines, but NOT results data loaded from a file.

2. Set the playback options. This includes the ability to listen to the data in its filtered or unfiltered format. This also includes selection of stereo or mono output. If stereo output is selected, the nasal signal is sent to the channel 1 output (left) and the oral signal is sent to the channel 2 output (right). This provides the user the opportunity to evaluate the relative strengths of the two channels in stereo. If mono output is selected, you must specify which of the two audio channels is output during playback, either the oral or nasal channel.

3. To listen to all the data in the active window, select **Speak All** from the **Speak** menu.

4. If the window is set to Contour display mode, you may optionally listen to a smaller range of the data. From the **Speak** menu, select **Speak Displayed** to listen to the range of data currently displayed, or choose **Speak Selected** to listen to the selected range of data. To listen to the data from the beginning to the current cursor location, select **From Start to Cursor**. To listen to the data from the current data cursor location to the end of the data, select **From Cursor to End**.

5. If the window is set to Bar display mode, the data cursor is at the location of the currently displayed frame of data, though it is not shown in the window. Therefore, you may listen to the data from the beginning to the currently displayed frame by selecting **From Start to Cursor** from the **Speak** menu, or you may listen to the data from the current frame to the end by selecting **From Cursor to End**.

6. A nasalance ratio contour or bar graph may be displayed in real time during audio output, or the window may remain blank, depending on the display mode setting. In addition, in Bar display mode, or in Contour mode when less than the total length of data is displayed, an indicator will move along the scroll bar below the data to show the current location of the data being spoken.

Saving Signal Data

You may save the two-channel (oral and nasal) signal portion of the Nasometer II data to an audio file in CSL signal file format or in wave audio file format, with the Nasalance contour optionally saved to channel 3 of a CSL signal file.

Note that audio signals are stored unfiltered in memory, and are filtered while processed in real time. Thus, to avoid the possibility of applying filtering to the data twice when the saved file is subsequently opened and analyzed for nasalance, the unfiltered audio signals are saved. To save the signal data to a file, proceed as follows:

1. Note that nasalance results loaded from a text or binary file are not supported by audio data. An error message will be displayed if the source signal is not available for the Nasometer II results in the active window. Signal data are available with nasalance results obtained using the record or analyze operations.

2. From the **File** menu, select **Save Signal Data**.

3. A standard Save As box is displayed. The stereo audio data may be saved in CSL signal format (with an NSP file extension) or in wave audio file format (with a WAV file extension). Select the type of file you wish to save from the Save as Type drop-down box. If necessary, scroll to the location to store audio files, then enter a filename in the File Name box. If not included with the filename, the appropriate file extension is automatically appended to the entered name when the file is saved. Click SAVE to save the file.

4. The nasal signal is stored in channel 1 and the oral signal is stored in channel 2 of the saved stereo audio file.

5. If saving the file in CSL signal file format, a Saving Signal Data box is displayed, giving the option of saving the Nasometer II contour data to channel 3 of the NSP file. Click YES to save the contour in channel 3, or click NO to save the audio data file without the contour data. As the wave audio file format supports only two channels of data, this option is not provided when saving WAV files.

Analyzing Signal Data and Displaying Nasometer II Results

Nasalance results may be computed from an existing stereo (2-channel) audio data file that contains signal data in channels 1 and 2. It is assumed that the nasal data is stored in channel 1 and the oral data is in channel 2. To analyze a waveform data file, proceed as follows:

1. You may analyze stereo signal data saved in CSL signal file format (.NSP) or wave audio file format (.WAV). When loading .NSP files, the sampled data must be stored in channels 1 and 2. Any data in channels 3 through 8 are ignored.

2. Note that any existing data are automatically deleted from the window when signal data analysis is initiated.

3. From the **File** menu, select **Open File and Analyze**.

4. A minimized signal window is created, and a standard Open box is displayed. Access the folder that contains the audio file to open and analyze, and select the type of audio file from the Files of Type drop-down box. A list of files of the specified type are displayed. Select the desired file from the displayed list, then click OPEN to complete the file loading operation. Note that if you CANCEL the operation, you must manually close the minimized signal window before running the routine again.

5. The waveform data from the selected file are loaded into the minimized signal window. This signal data is then analyzed, and the nasalance results are computed and placed in the Nasometer II data window. Depending on the display mode setting, these results may be displayed as a contour trace or as a bar graph display, or the results may be hidden. After analysis of the audio file is complete, the minimized signal window is closed.

6. You may optionally change display modes, and examine the captured Nasometer II data in each mode.

7. The numerical results and statistics may be computed and displayed.

8. Listen to the Nasometer II data by selecting **Speak All** from the **Speak** menu. In Contour display mode, you may optionally select a smaller range of data for audio playback. Depending on the setting for the Nasometer II display mode, a nasalance contour or bar graph may be re-displayed in the window during playback.

To define a key, proceed as follows:

1. Press INSERT. A box appears on the screen in which you may enter your key definition(s).

2. In the Assign Key Definition box, select a key and optional key class, enter the command string to execute in the Definition box, and type any textual information you wish to display on the status line in the Help box. If the selected key has already been defined, the command(s) appear in the key definition box. You may change this definition using simple line-editing techniques. If the key has not been defined, you may enter a command in the key definition box. You may also enter a sequence of commands, separating each command with a semicolon (;) and scrolling past the end of the box.

3. Most keys on the keyboard may be defined. Exceptions include ESC, ENTER, BACKSPACE, PRINT SCREEN, SCROLL LOCK, PAUSE, NUM LOCK and SPACEBAR. Also, any keys that are defined in the menu (menu hot keys) may not be redefined.

Loading Nasometer II Results from a File

You may load nasalance results previously saved in a numerical results text file, and display the nasalance results in the active window. It is also possible to load nasalance results from a binary file produced by the DOS version of the program, NM2. To load nasalance results from a file, proceed as follows:

1. Access the **File** menu, then select either **Open Nasalance Results File** (to load numerical results from a text file) or **Open DOS Nasalance Results File** (to load numerical results from an NM2 DOS binary file).

2. If the Nasometer II data window contains nasalance data when results are loaded, a message box is displayed warning that all existing data will be removed and asking for confirmation to continue. Click YES to continue with the file load operation, or click NO to cancel the operation.

3. A standard Open dialog box is displayed. If necessary, scroll to the location where your nasalance results files are stored. It is expected that Nasometer II output files have an OUT file extension, while DOS NM2 results files have a NAS file extension. A list of files in the folder having the expected file extension is displayed. Select the desired file from the displayed list, then click OPEN to load the file.

4. When nasalance results are loaded from a file, the data are displayed in the Nasometer II data window in accordance with the current display settings. For example, the results may be displayed in the active data window as a contour or bar graph display, or the results may be hidden, depending on the setting for Nasometer II display mode. However, the data display is not limited to the current display duration setting, but the entire length of data is displayed when results are loaded from a file.

5. You may optionally change display modes, and examine the captured Nasometer II data in each mode.

6. The numerical results and statistics may be displayed. The frame length/advance value was read from the file header of the loaded text file. For data loaded from a binary file, the frame length/advance is assumed to be 10 milliseconds.

7. Note that nasalance results plotted from a file are not supported by audio data.

Showing a Range of Data

Once you have graphical data in the Nasometer II data window when in Contour display mode, you may decide to display only a portion (range) of that data at a time, or you may want to display as much data as will fit into the window. Also, after changing the window attributes (such as pen color), you may re-display the data to reflect the new settings. To change the data display range, proceed as follows:

1. Note that a range of data may be displayed only when the Nasometer II data window is set to Contour display mode from the Nasometer II Setup box. In Bar display mode, the nasalance ratio for a single frame of data is displayed; in Empty display mode, nasalance results are not displayed.

2. From the **View** menu, you may elect to display all of the data by selecting **All Data**. To display only the data in the selection area, choose **Selected Data**. To display the data from the start to the current cursor location, choose **Start to Cursor**, and to display the data from the current cursor location to the end, choose **Cursor to End**.

3. If less than the full range of data is currently displayed, you may view the data 10 pixels to the left or right of the current display by selecting **Scroll Left** or **Scroll Right** from the **View** menu. **Page Left** and **Page Right** allow you to scroll through the nasalance contour in larger jumps.

4. A time domain scroll bar is displayed under the horizontal axis of the Nasometer II data window. This scroll bar also may be used to scroll through the data, and to increase or decrease the range of displayed data in the window.

Trimming Nasometer II Data

The nasalance contour may be edited to remove unwanted sections from otherwise satisfactory results. To trim the Nasometer II signal, proceed as follows:

1. The Nasometer II data window must be set to contour display mode. In addition, the window must contain nasalance results data that were not loaded from a file, as signal information is not stored in a numerical results file. Signal data are available with nasalance results obtained using the record or analyze operations.

2. To trim a portion of the signal, access the **Edit** menu and select **Trim Portions of Signal**. A sub-menu displays a number of options.

3. You may delete all data outside the selected region by choosing **Remove Signal Outside Selection**, or you may remove data within the selection area by choosing **Remove Signal In Selection**. To remove the data from the start of the file to the current cursor position, choose **Remove Signal Start to Cursor**. To remove data from the current cursor position to the end of the data, select **Remove Signal Cursor to End**.

4. Any editing operations performed on the nasalance contour will also be performed on the sampled data held in memory, so the sampled data always supports the contour for audio output.

Clearing the Nasometer II Data Window

You may clear the nasalance results to free up computer resources. Note that it is not necessary to clear data from a window before recording new data. To clear the active window, proceed as follows:

1. Before clearing the window, you may optionally compute and save the numerical results and statistics from the data. The signal portion of recorded data may also be saved.

2. From the **Edit** menu, select **Clear Nasometer Window**.

3. The existing nasalance results and supporting signal data are deleted from memory.

Exiting the Program

A command to quit the program and return to the Windows environment. To exit the program, proceed as follows:

1. From the **File** menu, choose **Exit Program**.
2. A box appears asking: **"Do you really want to exit?"**
3. Select YES to exit the program or select NO to return to program operations.

Printout of the Application Window

You may send the current graphics information in the work area to a printer. To generate a screen dump, proceed as follows:

1. From the **File** menu, select **Print Screen**.
2. A Screen Print dialog box is displayed on the screen. You may add a header to the printout by clicking the Header check box, then entering the desired text in the Header box. Similarly, you may add a footer to the printout by clicking the Footer checkbox and entering the desired text in the Footer box.
3. Click SETUP to access a Print Setup dialog box, where you may specify the printer to use, the page orientation, the paper size and the paper source. Click FONT to specify the font to use for the header and/or footer.
4. After entering any desired header or footer information, specifying the font and setting up the printer, click PRINT to send the graphics to the printer. Click CANCEL to abort the operation.

Using the Reference Cursor

Setting an appropriate reference nasalance ratio provides the patient with a tangible target during treatment sessions. For example, after inserting the reference cursor at a specific location, the patient can be instructed to try to stay below the target line while reading a stimulus passage. Nasalance results falling above and below the assigned targeted value are reported in the Statistics box. This allows you to quantify and track patient progress. To set the reference cursor, proceed as follows:

1. Placement of the reference cursor is set from the Nasometer II Setup dialog box. From the **Options** menu, choose **Select Nasometer Options**, then access the Reference tab.

2. Enter a value in the Reference Cursor edit box, or use the slider control to increase or decrease the current cursor location. After changing the value, click APPLY to apply the change to the active window, then click OK or CANCEL to close the dialog box.

3. The assigned target nasalance value is valid in all three display modes, although a reference cursor will not be displayed in Empty mode.

4. When in Contour display mode, the reference cursor is displayed as a horizontal line across the window at the set nasalance ratio value. If the reference cursor value is set outside the current display range, the cursor is placed at the top or bottom of the window, at the location closest to the set value. For example, if the window display range is set from 20% to 80% and the reference cursor is set at 10%, the reference cursor will be displayed at the 20% location.

5. When in Bar display mode, the reference cursor is displayed as a vertical line in the window at the set nasalance ratio value. If the reference cursor value is set outside the current display range, the cursor is placed at the left or right of the window, at the location closest to the set value. For example, if the window display range is set from 20% to 80% and the reference cursor is set at 10%, the reference cursor will be displayed at the 20% location.

6. When trying to lower a patient's nasalance level, the reference cursor can provide the patient with a clear, achievable goal.

Using the Timer Feature

A timer option is available for specialized recording situation in which you want to cue your patient to speak at a certain rate. This feature is especially useful when syllables are used as the test stimulus. To set the timer, proceed as follows:

1. The timing light is turned on or off from the Nasometer II Setup dialog box. From the **Options** menu, choose **Select Nasometer Options**, then access the Reference tab.

2. Set the color of the timer light by selecting one of the available colors listed in the Timer Color list box.

3. Set the number of timer "flashes" per second by increasing or decreasing the value in the Timer Rate edit box. Valid settings are from 0 to 5 pulses per second, where a setting of 0 has the effect of turning off the timer light, a setting of 1 sets the timer light to flash once per second, a setting of 2 sets the timer light to flash twice per second (i.e., once every 0.5 seconds), etc.

4. After making changes to any of the timer settings, click APPLY to apply the changes to the active window, then click OK or CANCEL to close the dialog box.

5. When the timer option is enabled, a small box appears in the window status bar during data capture. While recording, the timer color flashes on and off in this box according to the set timer rate.

Using the Command Line

Any command that is executed using the mouse and menus or toolbar may also be executed using the keyboard and command line. After you have gained some experience with the program, you may find that program operations are easier to control by using the command line. This is because the command line can be used to execute any combination of commands. The command line may also be more convenient as it not possible to place all command parameter permutations in the menus.

Please note that the Nasometer II command line cannot be used if the Stimulus Display window is active. Activate the Nasometer II data window by clicking on its title bar before using this program feature. Detailed instructions on using the command line may be found in the following sections: Accessing the Command Line, Viewing the Command Just Executed, and Editing the Command Line.

Accessing the Command Line

1. Any key that has not been defined as a function key will be recognized by the program as the first input character of a command. When this first key or the SPACEBAR is pressed, command line mode is automatically entered and the command line box appears. The desired command may then be entered from the keyboard. On-line help for all commands is available from the Program Reference book of this help file.

2. Entries may be typed in upper or lower case. When you have finished typing the command, press ENTER or click OK. The command will be executed and the command line will disappear. To close the command line box without executing the command(s) on it, press ESC or click CANCEL.

3. Several commands may be stacked on the command line before execution. All commands must be separated by a semicolon, but no space is needed between commands. The program will sequentially execute the commands in the string.

Docked Toolbar

A docked toolbar is attached, or "anchored," to one edge of the screen or application window. You can dock a toolbar below the menu bar, above the status bar, or to the left or right edge of the application window. When you drag the toolbar to one of these locations, the toolbar outline snaps to the length of the edge and can be docked to the edge by releasing the mouse button. Note that you cannot change the size or shape of a docked toolbar.

Editing the Command Line

1. You may perform simple line editing by using the BACKSPACE key to sequentially remove previously entered text, or you may use the mouse to select the text you wish to replace, and type over it. The LEFT ARROW, RIGHT ARROW, HOME, END and DEL keys are also active for editing purposes.

2. If a command is incorrectly entered resulting in an unrecognized command, an error message will appear on the computer screen to indicate this. Use BACKSPACE to redisplay the incorrect command and then use any of the above line edit keys to correct the command syntax. If you do not wish to review or edit the incorrect command syntax, simply re-enter the command.

3. You may also use BACKSPACE to recall the last executed command and then use the editing keys listed above to redefine the command to perform a new operation. (e.g., to speak a different range of data.)

Toolbar Location

As with other Windows applications, the program toolbar may be moved, hidden and re-displayed. To hide the toolbar, select Hide Toolbar from the Window menu. To re-display a hidden toolbar, select Show Toolbar from the Window menu.

Initially, the toolbar is displayed along the top of the application window, anchored (or docked) just below the menu bar. You may move the toolbar so it is anchored to a different edge of the application window, or you may move it to any location on the screen as a floating toolbar. If the toolbar is anchored, point between the buttons on the toolbar and drag it to a new location. If the toolbar is floating, point to the toolbar title bar and drag it to a new location. If you drag the toolbar to the edge of the application window, it will dock to the edge of the window automatically.

Viewing the Command Just Executed

After executing any command using the command line, menus or predefined keys, press BACKSPACE to view the command line containing the command. BACKSPACE displays only the last issued command. You can exit from the command line without executing the command by pressing ESC or clicking CANCEL. Using BACKSPACE and ESC to view commands that have been issued from the menus will enable you to become familiar with command syntax so that you can start to enter commands directly from the command line.

Using Configuration Files

A default program initialization file is included with the delivery. This factory default file is never altered by the program. When you run the program, a temporary user file is created which stores all work area layout and parameter setting changes made. You have the option of saving these changes to a permanent user configuration file or to another configuration file.

You can also activate other configuration files. Note that all parameter setting changes you make are saved in a temporary file until specifically written to the active initialization file, identified in a box on the application status line. Thus, you can discard the changes when the session ends, so that each session starts from the same configuration.

Each time a command is executed, the program searches for any required parameter settings first in the temporary copy of the active configuration file, which is identified on the status line. This temporary file contains any changes that have been made to the work area layout and parameter settings. If the required settings are not found, the program next looks in the user configuration file, if it exists, then finally in the factory-delivered default configuration file.

Saving Configuration Files

Note that all parameter setting changes you make are saved in a temporary initialization file until specifically written to the active file, which is identified in a box on the status line. Thus, you can discard the changes when the session ends, so that each session starts from the same configuration.

To save the settings in the temporary configuration file, proceed as follows:

1. When the program starts, a temporary copy of the active configuration file is created. The active file is usually the user configuration file. When the work area layout or command parameter settings are changed, these changes are written to this temporary file.

2. You have the option of saving changes stored in the temporary user file to the permanent user configuration file. Select **Configuration Files, Save (Update) the User Configuration File** from the **File** menu. The current window layout and parameter settings are copied from the temporary file into the user configuration file. Note that if the user configuration file is not active, an error message is returned.

3. You may create a number of configuration files, each designed to configure the program for a specific task. These configuration files can be used, for example, to define the work area layout and program variables for use in a macro.

4. Save the changes in the temporary file to a configuration file other than the active file by selecting **Configuration Files, Save a New Alternate Configuration File** from **File** menu. A standard file saving box is displayed, allowing entry of the drive, directory location, and name for the configuration file. An INI file extension is appended to the filename, to identify the file type. Click OK to complete the file save operation. The current window layout and parameter settings are copied from the temporary file into the named configuration file. Note that writing these settings to a different file does not change the active configuration file.

Activating Configuration Files

WARNING: When you reset the program, existing windows are deleted and all data are lost. Before executing any of these commands, you should save any data that you want available at a later time to disk storage.

1. At any time, you can reset the program to the default (factory delivered) configuration by selecting **Configuration Files, Reset the User Configuration to Factory Settings** from the **File** menu. This will delete both the permanent and temporary copies of the user configuration file, if it exists, before redrawing the work area with the default layout. A new temporary file is created to store all parameter changes made, which may be written to a permanent user configuration file.

2. You can reset the program to the work area layout and parameter settings defined in the user configuration file, if it exists. Select **RESET (to the User Configuration)** from the **File** menu. The temporary user file is deleted and the user configuration file becomes the active initialization file. A new temporary user file is created to store all parameter changes made, which may be written to a permanent user configuration file.

3. If you have created other configuration files, you can reset the program to any saved configuration by selecting **Configuration Files, Reset to an Alternate Configuration** from the **File** menu. The named configuration file becomes the active file, and the configuration file box on the status line is updated to display the name of this file. Any subsequent changes to the work area layout or parameter settings are written to a temporary copy of this active file until specifically saved.

4. In each case, a warning message is displayed before the program configuration is reset. Click YES to continue with the operation; click NO to cancel the request to reset.

Window Attributes

You may change the pen color and turn on or off the display of the scroll bar in the Nasometer II data window. To set the window attribute options, proceed as follows:

1. To set the display options for the Nasometer II data window, choose **Window Attributes** from the **Window** menu.

2. A box appears in which you can change the window attributes, including the color of the drawing pen and the display of the scrollbar in the Nasometer II data window. Note that application of normalization to the data in the window, and placement of horizontal and/or vertical grid lines across the window, are not applicable to windows initialized for Nasometer II operations.

3. Once you change a window display setting, you may re-display the existing data with the new window settings if you wish to change the display properties of the existing data. This may be done from within the Window Options dialog box by clicking APPLY.

4. To close the dialog box and save the changes to the parameter settings in the initialization file, click OK. To close the dialog box without saving the changes, click CANCEL.

5. Window attributes cannot be applied to the Stimulus Display Window.

Defining a Keyboard Key

A number of keys on the keyboard are initially pre-defined to execute program commands. For example, pressing F1 starts the Help program, and pressing the Ctrl+R combination opens a dialog box for setting the Nasometer II options. Users may define their own short-cut keys and key combinations to execute frequently performed operations.

Macro Functions

A command file (or macro) is a text file that contains a list of commands, which will be sequentially executed when the macro is run. You may create a command file while executing program commands by setting the program into "learn" mode. All subsequent commands and command parameters that are executed (with the exception of macro commands) will be recorded to a macro file.

Macros provide an easy way to repeat a series of commands that would otherwise have to be implemented one at a time. If any process you are performing requires repetitive steps, you may consider using a macro to speed up the process. Also, macros ensure that the exact same sequence of commands are used each time. After creating a macro file, you may define a keyboard key to run the macro.

Commands may be entered by using the command line, the menu line, the toolbar; or pre-defined keys. Commands executed using a window Control menu are not recorded. You must use the command line to begin creation of the macro file from within the Nasometer II program. Alternatively, if you are familiar with Nasometer II command syntax, you may create the command file using an external text-editing program.

Creating a Macro Command File

1. To begin recording a macro, press the SPACEBAR to activate the command line, then type "MACRO LEARN; MACRO DISPLAY". The program is set to macro "learn" mode, and a macro dialog box is displayed in the work area.

2. Macro files may also be created externally to the program. Use any standard text editor to create or edit a macro file containing a series of commands, which the program will recognize and perform. This file of commands is then named and saved. Complete descriptions of all Nasometer II commands are included in this help file.

3. Generally, the first command in a macro is to configure the work area so that windows are displayed and program parameters are set appropriately for the macro. To do this, select **Configuration Files** from the **File** menu, then select **Reset to an Alternate Configuration** from the displayed submenu. A box displays a list of existing initialization files in the default Nasometer II templates folder. Select the desired configuration file from the displayed list, then click OK.

Displaying or Hiding the Macro Dialog Box

1. The macro dialog box is displayed by typing the command "MACRO DISPLAY" on the command line. If you have hidden the macro dialog box, you may re-display it by re-entering this command.

2. The macro dialog box displays the macro commands after they are executed. Also, several buttons appear inside the box that execute certain macro commands. If the macro has been named, the filename appears at the top of the dialog box.

3. To remove the box from the work area, click on HIDE inside the macro dialog box.

Exiting Macro Record Mode

1. If you started the macro by re-configuring the work area and setting the program parameters, you must add a command at the end of the macro to restore the program configuration that existed prior to macro execution. To add this command to the macro, press the SPACEBAR to access the command line, then type "SET FROM.NOSAVE INI". Note that this command activates the previous configuration file only. If you want to restore the work area to a different configuration, select **Configuration Files, Reset to an Alternate Configuration** from the **File** menu, then select the desired initialization file from the displayed list.

2. To exit macro record mode, do one of the following:

   a. On the command line, type "MACRO EXIT".

   b. If the macro dialog box is displayed, click EXIT.

3. If the command file has been modified and the changes have not been saved, you will be asked if you wish to save the changes before exiting. Select YES to save the changes and exit macro mode. Select NO to exit macro mode without saving changes to the macro file. Select CANCEL to cancel the operation and return to macro learn mode.

Program Configuration Files for Macros

1. To ensure smooth running of a macro file, it is desirable to set the program parameters in a specific manner. When macro execution is completed, you want to restore the previous settings for normal program operation. You may create program configuration files, and select which configuration file to use.

2. Set the program analysis and display options. When the program is configured to your liking, save the window layout and parameter settings to a file. Access the **File** menu and select **Configuration Files**, then choose **Save A New Alternate Configuration File** from the displayed submenu.

3. A standard File Saving dialog box is displayed in which you may enter a name (and optionally the drive and directory location) for the file. An INI file extension is automatically appended to the filename to identify it as a configuration file. Click OK to complete the file save operation.

4. When you create a macro, include a command at the beginning to re-configure the work area and set the parameters appropriately for the task by activating a saved configuration file. Include a command at the end of the macro to restore the settings that existed before macro execution began by activating the previous configuration file.

Removing a Command from the Macro

1. If the last command was incorrectly specified, you may delete it from the command file by typing "MACRO UNDO" on the command line.

2. Alternatively, if the macro dialog box is displayed in the work area, you may select any line in the Macro Commands box that you want to delete and click UNDO. Then click within the work area and continue recording your macro.

Running an Existing Macro

1. Once you have created and saved a macro command file, you may run it in from within the program. Note that, as a rule, the first command in a macro is to re-configure the work area so that windows are displayed and program parameters are set appropriately. Existing windows, and all data in them, are deleted before the new windows are displayed. **You must save any existing data that you want available at a later time to a file before you run a macro.**

2. To run your macro, press the SPACEBAR to activate the command line, then type "MACRO RUN".

3. A Load Macro File dialog box appears in which you may select the macro file you wish to run. If the desired macro file is not listed, scroll through the directories until you find the file. If the file extension is not .MAC, change the extension in the List Files of Type box.

4. Click OK to run the selected file, or CANCEL to cancel the operation.

5. If you run a macro often, you may wish to define a keyboard key to run the macro.

Saving the Macro While Recording

1. To save the macro file without exiting macro learn mode, do <u>one</u> of the following:

   a. On the command line, type "MACRO SAVE".

   b. If the macro dialog box is displayed, click SAVE.

2. The program will display a Save Macro File dialog box. Select the directory location for the macro file and enter a file name. Then click OK or press ENTER to save the macro.

3. The program will automatically add a .MAC extension to the file when it is saved.

Filtering of the Signal

When recording new data, the oral and nasal data are each passed through an analog filter before digitization. The filtered signals are stored in memory, and are filtered while they are processed in real time. The nasalance ratio is computed from the filtered signal.

The characteristics of the filter are as follows: Band pass filter with its center frequency at 500 Hz, its low frequency (-3 dB) cutoff at 300 Hz, and its upper frequency cutoff at 750 Hz.

When saving the signal portion of the Nasometer II data to an audio file, it is the filtered oral and nasal signals that are saved. This will provide audio playback of the filtered speech.

When re-playing the data, the user can select whether to monitor the audio signal in its format.

Chapter 4 – Clinical Protocol Recommendations

Overview

This chapter provides hints on using the Nasometer II in your clinic. It assumes that you have read and understood the basic operation of the system and does not cover key strokes, mouse clicks, etc.

Strengths and Limitations of Nasometry

The Nasometer has attained widespread usage because it is simple to use and provides clinicians with valuable, objective information. Most clinicians are "up and running" very quickly after acquainting themselves with the software, placement of headgear on the patient, etc. Calibration is a quick and simple process.

Data collected on standardized reading passages, each with normative data, provide clinicians with a benchmark to compare their patients' performance. The instrument is non-invasive and the procedure can be administered quickly. Clinicians can use this data when participating on evaluation teams (e.g., craniofacial, stroke, etc.) to help with patient assessment and treatment plans.

Unlike other tools that are strictly used for assessment, the Nasometer can also be used to help modify resonance patterns with real time visual biofeedback. Mature clients can even learn to use the instrument without the clinician present after exercises and goals have been clearly defined.

Given these strengths, the Nasometer has proven itself to be an excellent clinical tool. The bibliography supplied with this manual overwhelmingly supports this point of view.

The Nasometer, however, should not be viewed as an independent diagnostic tool. It is not meant to replace endoscopy, pressure/flow studies (though it has been shown to correlate highly with the latter; see Dalston, et al., 1991), or other instrumental procedures used to assess velopharyngeal function. It should be used as part of a multifaceted diagnostic process with multiple professional disciplines involved. As an acoustic analysis tool, underlying physiology can only be inferred, not ascertained.

Preparing to Evaluate a Patient

Before you use the instrument with patients, practice complete nasometric evaluations with fellow staff members from beginning to end. This will get you more comfortable with the software, saving/printing files, placing the headset on another person (which is quite different from putting it on yourself), etc. If possible, practice an evaluation with a child you know and get used to adjusting the headgear on smaller heads, etc.

Some other important preparatory steps include:

1. Make sure the headset separation plate is cleaned, and, if necessary, disinfected before placing it on the patient. To disinfect, use procedures as required by your facility (e.g., use a germicidal wipe to disinfect the plate and replace the plastic guard around it). These guards can be soaked in a germicidal solution and reused. Do not get the microphones wet when disinfecting. ETO gas sterilization can be used, if required. If gas sterilization is used, clinicians should calibrate more frequently to ensure that the microphone sensitivity has not been affected.

2. The instrument should be calibrated. While not necessary before every procedure, the instrument should be calibrated periodically to ensure valid data collection.

3. For young children, it may be necessary because of fear, shyness, etc. to engage in play therapy prior to placing the headgear on. Having other types of headgear (e.g., hats, helmets, etc.) available for use in play therapy prior to the evaluation has been reported by clinicians to help desensitize children to putting on the nasometric headgear.

Administering the Evaluation

1. Explain to the patient that he/she will be reading a few simple passages. Instruct the patient not to say anything other than what appears on the screen. Most reading passages or stimulus sets cannot be placed, in their entirety, on the stimulus view screen. You will need to scroll to the next part of the passage. It will be necessary to pause briefly when scrolling down the remainder of the reading passage; instruct the patient when and where to resume reading.

2. Silence does not affect computed mean nasometric scores. Therefore, do not be concerned if the patient pauses between sentences, etc. If the patient inadvertently speaks to you during data collection, edit out the section immediately (i.e., stop data collection and use cursors to surround the extraneous data and delete). After editing, resume with the passage reading. Do not wait until the passage is completed to edit extraneous speech; it may not be possible to locate the undesired section with 20 or more seconds of data on the screen.

3. For those unable to read (preliterate children or neurologically impaired adults), you should practice the "repeat after me" sequence necessary to get through the passages prior to initiating data collection. Keep the phrasing as short as necessary so that the patient repeats the stimulus verbatim. Using the MacKay-Kummer passages (see the "Simplified Nasometric Assessment Procedures" section later in this chapter) may be advantageous for preliterate children because of their ease of pronunciation, etc.

4. Time-axis selection during data acquisition is a user preference. Some clinicians prefer to use a two-second time axis while collecting data and then change to, say, 40 seconds after data has been collected to see the entire passage on the screen. Others preset the time axis to the predicted period of time needed to read the passage. If you select **Analysis** on the Main Menu and then **All Data**, it doesn't matter what the time axis is; the program considers data both on and off the screen. However, to view patterns of nasalance graphically, you should view the entire passage on the screen (see the following section "Interpreting a Nasogram").

5. If the patient is speaking too loudly, you will see the overload indicator light up. Simply instruct the patient to speak more softly.

6. After completing a passage, save the nasalance data and go to the next passage. If you save the nasalance data, you can always analyze it statistically, or print it, etc., later. It is important to look at the configuration of the nasogram as well as to consider the mean nasalance score. Therefore, it is generally recommended that you save the nasalance data and not simply the statistics, though saving statistics alone, without the raw data, is an option.

7. Make sure to clear the screen of data before you go to the next reading passage. Otherwise, the mean nasalance score on the subsequent passage will be averaged with the previous passage.

8. Proceed to the other passages required for your assessment. One passage devoid of nasals (for hypernasality detection) and one passage loaded with nasals (for hyponasal detection) should generally be used for assessment. The Rainbow Passage, while a standard reading passage in the field, is not particularly revealing clinically for nasometric assessment (see Dalston and Seaver, 1992), though some clinicians continue to administer it. Additionally, it is a more time-consuming passage to administer (i.e., due to length), and it has words which many children have difficulty pronouncing.

9. The MacKay-Kummer passages (1993) and picture stimuli are now available with normative data to facilitate data collection on preliterate children. See the special protocol considerations for these passages written by MacKay and Kummer for this manual under the heading "Simplified Nasometric Assessment Procedures" later in this chapter.

Interpreting a Nasogram

A nasogram is a contour display of an entire passage on the screen (e.g., normally about 20 seconds for the Zoo Passage, though it may be necessary to use 40 seconds if there are many pauses). Clinicians usually rely heavily on the calculated value of mean nasalance for a given passage and compare it to normative data. However, there is also valuable information in the nasogram itself, specifically its configuration. The following suggestions may be beneficial in viewing a nasogram:

1. A high and flat nasalance contour for the Zoo (or other non-nasal) Passage suggests gross anatomical or neurological deficiency.

2. A low and flat contour suggests obstruction of the nasal passageways. The nasal sentences test should also show a depressed nasalance score.

3. Gradual rise in the curve across time suggests muscle weakening as from myasthenia gravis.

4. Marked variations in nasalance across time which may or may not be linked with occurrence of nasal consonants. This suggests discoordination in velopharyngeal valving.

5. Nasalance variability not linked closely with the phonetic characteristics of the spoken materials suggests reduced sensory awareness of nasal versus oral airflow as in the hearing impaired.

6. Less than 10% difference in nasalance level with and without an obturator in place suggests that the obturation is insufficient to produce optimal reduction of nasalance.

Original Standardized Reading Passages (English)

The original Nasometer contained the three standardized passages presented below. Normative data for each are reported in the next section.

Zoo Passage

Look at this book with us. It's a story about a zoo. That is where bears go. Today it's very cold out of doors, but we see a cloud overhead that's a pretty, white fluffy shape. We hear that straw covers the floor of cages to keep the chill away; yet a deer walks through the trees with her head high. They feed seeds to birds so they're able to fly (Fletcher, 1972).

The Zoo Passage excludes nasal consonants.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow (Fairbanks, 1960).

The Rainbow Passage contains 11.5% nasal consonants.

Nasal Sentences

Mama made some lemon jam.

Ten men came in when Jane rang.

Dan's gang changed my mind.

Ben can't plan on a lengthy rain.

Amanda came from Bounding, Maine.

In the Nasal Sentences, 35 percent of the phonemes are nasal consonants. This is more than three times as many as would be expected in standard American English sentences.

Normative Data on Nasometer II (Software Version 2.6 and Higher)

Normative data has been collected at Kay Elemetrics on 40 adult subjects using the Nasometer II. Over time, additional normative studies will likely be collected at various facilities on different age groups. Kay will post these results on its web site as they become available.

Test Passage	Mean Nasalance	SD of Mean
Zoo Passage	11.25	5.63
Rainbow Passage	31.47	6.65
Nasal Sentences	59.55	7.96

MacKay and Kummer have reported normative data on additional passages designed for preliterate children (SNAP Test). A description of protocol for administering these new passages as well as normative data are covered in the section "Simplified Nasometric Assessment Procedures". These data have not yet been collected for Nasometer II. They will be published on Kay's Web site (www.kayelemetrics.com) when available.

Interpretation of Patient's Score in Relation to Normative Data

There are no rules engraved in stone governing when a patient's nasometric assessment results should be considered abnormal. For example, some normal subjects will score as high as 25% on the Zoo Passage. While this score exceeds two standard deviations from the mean, one cannot classify these patients as abnormal though they may sound somewhat nasal. The complex considerations of setting cut-off scores for normal vs. abnormal are beyond the scope of this manual. Fortunately, the professional literature contains articles addressing this very issue.

The user is encouraged to read a thorough discussion of "cut-off scores" between normal and abnormal by Dalston, et al. "Use of nasometry as a diagnostic tool for identifying patients with velopharyngeal impairment." The Cleft Palate-Craniofacial Journal, Vol. 28 (2), April 1991, pp. 184-189 and, additionally, Dalston, et al. "Nasometric sensitivity and specificity: A cross-dialect and cross-culture study." The Cleft Palate-Craniofacial Journal, Vol. 30 (3), May 1993, pp. 285-291. These studies provide the rationale for using cut-off scores, their validity, and their potential variability among different dialects and languages. See also the MacKay-Kummer section titled "Scoring and Clinical Interpretation" found later in this chapter.

It should be reiterated that clinicians should not base their classification of a patient solely on a Nasometer II evaluation. Data obtained from the Nasometer should be applied to the complete "clinical picture" and considered in the context of all diagnostic findings.

Treatment

This manual provides a few guidelines and sample material when working with patients on nasalance shaping routines. These are intended to be used as a starting point only. Clinicians will incorporate nasometry exercises into previously developed clinical treatment protocols. The Nasometer should help enhance, but not replace, these traditional treatment approaches. Clinicians will, hopefully, further develop their own approaches to treating nasality problems as they become more familiar with the instrument. The following guidelines have been used successfully by the developers of the Nasometer and should serve as a good starting point.

Preferred Display Formats for Treatment

Again, this is a user preference. Experiment with the different formats: filled contour display, bar display, inverted contour display, etc. Also, different patients may develop display preferences for their therapy tasks.

The Bar mode, for example, is very intuitive for single phoneme exercises, and when you, as the clinician, are trying to explain basic concepts (e.g., sustaining an "ah" and then an "m," and observing the gross differences in the Bar mode). However, during running speech the Bar mode may appear somewhat "jumpy" and less appealing.

The filled contour display with a 4-second time axis provides effective visual feedback and is graphically appealing. Recall, also, that the nasalance scale can be inverted (i.e., 0% is placed at the top and 100% is at the bottom). If the therapy goal is to decrease nasalance, inverting the scale may be visually more rewarding to the client (especially children): more of the display is "filled in" for good speech and less filled for nasalized speech.

The reference cursor line (green) can serve two important functions in therapy. It is useful for visually prompting the patient: "Here is the goal for this exercise; try to keep the nasalance trace below this horizontal marker." Secondly, after the exercise, clinician and client can see how well this goal was met, using objective data (i.e., % above and below the threshold). This can serve as the basis of charting progress in therapy and changing therapy goals.

Single Phoneme

Exercises by using the "Bar" mode display on the Nasometer, resonance placement on single phoneme productions can be easily monitored and trained. The threshold line, or visual target, can be set and moved according to the needs and capabilities of the individual patient to provide visual biofeedback of valving behavior.

For example, when a newly-fitted prosthetic device is used, or when cleft repair surgery has been done, a simple and objective visual display of client performance is desirable. This will, even on a low level task such as achieving and maintaining low nasalance on a sustained "ah" production, enhance the patient's understanding of a difficult concept while reinforcing appropriate valving behavior. By setting a tangible target at which to adjust behavior and gauge improvement, the clinician can provide the patient with an easily understandable, easily attainable goal that translates into immediate success.

Kay recommends that the clinician experiment with the use of this display for single phoneme tasks (using his or her own speech) to understand the range of benefits and limitations inherent in such exercises.

Principles for Selecting Therapy Tasks

1. While the single phoneme exercise is appropriate when therapy is initiated, the clinician should quickly progress to sets of sentences or phrases as stimuli.

2. Generally start phrase/sentence sets with material containing only low or mid vowels and liquid consonants (approximants). Progress to material containing stop consonants, and then sibilants. Material with sibilant sounds and high vowels should be introduced much later in the treatment program. (Sentence groups developed using these principles are provided in the next section; these can be used as a starting point for clinicians.)

3. Set the initial threshold about 10% above the mean nasalance level obtained during utterance of the Zoo (or other non-nasal) Passage. A higher level is used to ensure initial success in meeting criterion.

4. When success is achieved with 90% or more of the sentences, reduce the threshold goal in 5 to 10% decrements. If possible, the client should be allowed to help identify when the criterion has been met and when a lower goal threshold is appropriate.

5. If success is not achieved or maintained at a selected threshold, raise the threshold in 10% increments and proceed.

6. If the client cannot maintain a reduced level of nasalance achieved, physical intervention to increase velopharyngeal valving capabilities should be considered.

Sentence Lists for Modification of Nasal Resonance (English)

The following pages contain lists of sentences that have been grouped by sounds (Fletcher, 1978). Each list categorizes the individual components found in each sentence.

List 1A - Balanced for Approximants* with Low- and Mid-Vowels

Sentence	l	r	w	j	h	Total
1. Where are ya?	-	2	1	1	-	4
2. Haul your roll.	2	1	-	1	1	5
3. Air her ware	-	3	1	-	1	5
4. "Ha, ha," a yo yo.	-	-	-	2	2	4
5. Holler, "Walla, Walla."	3	1	2	-	1	7
6. Were all well?	2	1	2	-	-	5
7. Yell, "Hello, Earl."	3	1	-	1	1	6
8. Roll your hair.	1	3	-	1	1	6
9. Ya'll row, Aurora.	1	3	-	1	-	5
10. A lower yellow wall	3	1	1	1	-	6
11. Were ya well?	2	3	1	1	-	7
12. Your war laurel	1	2	2	1	-	6
13. Where were ya'll?	2	1	1	-	-	4
14. All are well.	1	2	-	1	-	4
15. Are ya all air?	1	1	-	-	2	4
16. A hare hollow	1	1	-	-	1	3
17. A whole aura	1	4	-	1	-	6
18. Your lower roar	-	-	2	-	1	3
19. Her war woe	-	2	1	1	1	5
20. Were ya her?	1	1	2	1	-	5
Total in list	25	33	16	14	12	100
Percent in list	25	33	16	14	12	100

*The approximants are defined by Ladefoged as produced by "approximation of two articulators without producing a turbulent airstream." (Ladefoged, P., Preliminaries to Linguistic Phonetics, Chicago: Univ. Chicago Press, 1971, p. 46.)

List 1B - Balanced for Plosives with Low- and Mid-Vowels and Approximants

Sentence	p	b	t	d	k	g	Total
1. Get a table.	-	1	2	-	-	1	4
2. Dad had a tag.	-	-	1	3	-	1	5
3. Dot caught a lot.	-	-	3	1	1	-	5
4. Pat the baby.	1	2	1	-	-	-	4
5. Tell a gag.	-	-	1	-	-	2	3
6. Call a cat.	-	-	2	-	2	-	4
7. Doc kept a cup.	2	-	1	1	3	-	7
8. Tack a tad.	-	-	2	1	1	-	4
9. Talked a lot.	-	-	3	-	1	-	4
10. Capped a bottle	1	1	2	-	1	-	5
11. A pet called Dot	1	-	2	2	1	-	6
12. Caught the ball	-	1	1	-	1	-	3
13. Cut a dot.	-	-	2	1	1	-	4
14. Taught a dog	-	-	2	1	-	1	4
15. A tot got wet.	-	-	3	1	-	1	5
16. Tapped a cat	1	-	3	-	1	-	5
17. A red hotel	-	-	1	1	-	-	2
18. Pat got a dud.	1	-	2	2	-	1	6
19. A bold tack	-	1	1	1	-	-	4
20. A door tab	-	1	1	1	-	-	3
Total in list	7	7	37	15	14	7	87
Percent in list	8	8	43	17	16	8	100

List 1C - Balanced for Nonsibilant Fricatives with Low- and Mid-Vowels and Approximants

Sentence	θ	ð	ʃ	v	Total
1. Have a throw.	1	-	-	1	2
2. The weather of Thor	1	2	-	1	4
3. The other feather	-	3	1	-	4
4. Of the other half	-	2	1	1	4
5. Velva wove the heather.	-	2	1	3	6
6. Love the father.	-	2	1	1	4
7. The elf over there	-	2	1	1	4
8. Rove their wave.	-	1	2	-	3
9. Have the elf there.	-	1	-	2	3
10. Their other wrath	-	2	1	1	4
11. Over there, Huff.	1	2	-	-	3
12. Wave for Rover.	-	-	1	2	3
13. Rather the other Thor	1	3	-	1	5
14. Half of fourth	-	-	2	-	2
15. Throw off four.	1	-	2	-	3
16. Rather the heather thereof	-	4	-	1	5
17. Have the feather though	-	3	1	1	5
18. The other thoroughfare	1	2	1	-	4
19. Whether the father hath	1	3	1	-	5
20. Off of the weather	-	2	1	1	4
Total in list	8	36	16	17	77
Percent in list	10	47	21	22	100

List 1D - Balanced for Sibilants with Low- and Mid-Vowels and Approximants

Sentence	s	z	ʃ	ʒ	tʃ	dʒ	Total
1. A lass saw walls.	2	1	-	2	-	-	5
2. Zorro has soul.	1	2	-	-	-	-	3
3. Wash a cell.	1	-	1	-	-	-	2
4. Swallow a sauce.	3	-	-	-	-	-	3
5. Sew a shawl.	1	-	1	-	-	-	2
6. Sell a saucer.	3	-	-	-	-	-	3
7. Yes, Rosses roses	1	3	-	-	-	-	4
8. Yes sir, Sal.	3	-	-	-	-	-	3
9. Less saucer wells	3	1	-	-	-	-	4
10. Ross says "sell".	3	1	-	-	-	-	4
11. Latch Roses sashes.	1	3	1	-	1	-	6
12. Show a horse.	1	-	1	-	-	-	2
13. Watch your hatches.	-	1	-	-	2	-	3
14. George was hoarse.	1	1	-	-	-	2	4
15. Elsa's has hash.	1	1	1	-	-	-	3
16. Lasso hosses jaw	2	1	-	-	-	1	4
17. Sal has a rash.	1	1	1	-	-	-	3
18. Russ rows as us.	2	2	-	-	-	-	4
19. Wassel was a loss.	2	1	-	-	-	-	3
20. Or else hers has	1	2	-	-	-	-	3
Total in list	33	21	6	-	3	3	66
Percent in list	50	32	9	0	4	4	99

List 2A - Balanced for Approximants with High- and Mid-Vowels

Sentence	l	r	w	j	h	Total
1. Who will weigh?	1	-	2	-	1	4
2. You'll hire Ray.	1	2	-	1	1	5
3. We hurry away.	-	1	2	-	1	4
4. Our weary wail	1	2	2	-	-	5
5. Yeah, real hero.	1	2	-	1	1	5
6. You really hear.	1	2	-	1	1	5
7. Allow Lee higher.	2	1	-	-	1	4
8. A rear wheel way	1	2	2	-	-	5
9. We'll rile Willie.	3	1	2	-	-	6
10. Our early hour	2	-	1	1	-	4
11. I'll rule Iowa.	2	1	1	-	-	4
12. Weigh wire wool.	1	1	3	-	-	5
13. You'll yell yeh!	2	-	-	3	-	5
14. Hurray, you're here.	-	3	-	1	2	6
15. We'll allow Hugh.	1	3	-	-	-	4
16. You're really wary.	1	3	1	1	-	6
17. Lure Rea away.	1	2	1	-	-	4
18. Rue a rye year.	-	3	-	1	-	4
19. Rally a Yale hurrah.	2	2	-	1	1	6
20. Willow, Ohio, railway	2	2	2	-	1	7
Total in list	25	33	19	11	10	98
Percent in list	26	34	19	11	10	100

List 2B - Balanced for Plosives with High- and Mid-Vowels and Approximants

Sentence	p	b	t	d	k	g	Total
1. Did Kit irritate Wade?	-	-	3	3	1	-	7
2. Patty tapped a boy.	2	1	3	-	-	-	6
3. Tweedle-Dee tooled a boot.	-	1	3	3	-	-	7
4. Would you like a toot?	-	-	2	1	1	-	4
5. Could you wait a bit?	-	1	2	1	1	-	5
6. I took a little book.	-	1	2	-	2	-	5
7. Glade tied a blue boot.	-	2	2	2	-	1	7
8. Kurt tried a bird.	-	1	2	3	1	-	7
9. Put a cutter to it.	1	-	4	-	1	-	6
10. Today we deal a tight card.	-	-	3	3	1	1	8
11. Take a cake, too.	-	-	2	-	3	-	5
12. "Keep out," Toby cried.	1	1	2	1	2	-	7
13. "Play right," Gill replied.	2	-	1	1	-	1	5
14. Clear twilight grew gray.	-	-	2	-	1	2	5
15. Tie a white gate.	-	-	3	-	-	1	4
16. Look to a tree toad.	-	-	3	1	1	-	5
17. Cut a tight platter.	1	-	4	-	1	-	6
18. Greg took a dart.	-	-	2	1	1	2	6
19. Did Trudy get wheat?	-	-	3	3	-	1	7
20. Tip a tool today.	1	-	3	1	-	-	5
Total in list	8	8	51	24	17	9	117
Percent in list	7	7	44	21	15	8	102

List 2C - Balanced for Nonsibilant Fricatives

Sentence	θ	ð	f	v	Total
1. Feel alive with youth.	1	-	1	1	3
2. The flea flew thither.	1	2	2	-	5
3. Either thee or thou	-	3	-	-	3
4. If they follow there	-	2	2	-	4
5. The eve of thy vow	-	2	-	3	5
6. Will either flower wither?	-	2	1	-	3
7. Fool, revive thy wife!	-	1	2	2	5
8. They weave the veil.	-	2	-	2	4
9. The life they live	-	2	1	1	4
10. Either Ruth or Luther fry.	2	1	1	-	4
11. View the fellow their.	-	2	1	1	4
12. They fly every valley.	-	1	1	2	4
13. Few loathe the earth.	1	2	1	-	4
14. Leave via the roof.	-	1	1	2	4
15. Faith threw the olive.	2	1	1	1	5
16. Wave forth the veil.	1	1	1	2	5
17. The evil, vile oaf	-	1	1	2	4
18. Thou very frail waif	-	1	2	1	4
19. Either the thigh or the wither	1	4	-	-	5
20. They fear thy rival.	-	2	1	1	4
Total in list	9	33	20	21	83
Percent in list	11	40	24	25	100

List 2D - Balanced for Sibilant Sounds with High Vowels

Sentence	s	z	ʃ	ʒ	tʃ	dʒ	Total
1. Gee, he chose Jessie.	1	1	-	-	1	2	5
2. Whose sis is Sue?	3	2	-	-	-	-	5
3. Sherry's choice is Cecil.	3	2	1	-	1	-	6
4. A seal is usually social.	2	1	1	1	-	-	5
5. Erase his seesaw.	3	1	-	-	-	-	4
6. See how Susie sighs.	3	2	-	-	-	-	5
7. Ulcers surely are silly.	2	1	1	-	-	-	4
8. Loose wages will cease.	3	1	-	-	-	1	5
9. Use a Swiss chisel.	2	2	-	-	1	-	5
10. Release her sassy weasels.	3	2	-	-	-	-	5
11. Celia issues erasers.	2	2	1	-	-	-	5
12. Seal his celery juice.	3	1	-	-	-	1	5
13. He is a horse racer.	2	1	-	-	-	-	3
14. A seahorse is sly.	3	1	-	-	-	-	4
15. Sally hears swishes.	2	2	1	-	-	-	5
16. Seize a high salary.	2	1	-	-	-	-	3
17. Shirley is seriously shy.	2	1	2	-	-	-	5
18. Chase sour rice away.	3	-	-	-	1	-	4
19. Scissors sure chase lace.	2	2	1	-	1	-	6
20. Use a sea zoo.	1	2	-	-	-	-	3
Total in list	47	28	8	1	5	4	92
Percent in list	51	30	9	1	5	4	100

List 3A - Balanced for Low- and Mid-Vowels with Sibilants (Includes Approximants and Plosives)

Sentence	ð	ɛ	æ	ʌ	a	o	s	z	ʃ	3	tʃ	d_3
1. Bass tops a toss.	-	-	1	1	2	-	3	-	-	-	-	-
2. Pa saw saucy Tess.	-	1	-	-	3	-	4	-	-	-	-	-
3. Sal said "Pass a salt."	-	1	2	1	1	-	4	-	-	-	-	-
4. "Spell sack," asked Wes.	-	2	2	-	-	-	4	-	-	-	-	-
5. Cuz Buzz has rugs.	-	-	1	3	-	-	-	4	-	-	-	-
6. Rose's closet was closed.	-	-	-	2	2	2	-	5	-	-	-	-
7. As a pause goes	-	-	1	1	1	1	-	3	-	-	-	-
8. Does a Zed zag?	-	1	1	2	-	-	-	3	-	-	-	-
9. Shaw shot a shop shadow.	-	-	1	1	3	1	-	-	4	-	-	-
10. Shad brushed a shack cashier.	-	-	3	2	-	-	-	-	4	-	-	-
11. Wash a shop-shelf shawl.	-	1	-	1	3	-	-	-	4	-	-	-
12. Show a shallow gash.	-	-	2	1	-	2	-	-	3	-	-	-
13. Treasure a casual beige garage.	1	2	1	4	1	-	-	-	-	4	-	-
14. Attach a church chapel chart.	1	-	2	2	1	-	-	-	-	-	4	-
15. Dutch lurched at Cha Cha.	1	-	1	1	2	-	-	-	-	-	4	-
16. Check a latched hatch.	-	1	2	1	-	-	-	-	-	-	3	-
17. Coach watched a chalk chat.	-	-	1	1	2	1	-	-	-	-	4	-
18. JoJo judged a jelly jar.	-	1	-	2	1	2	-	-	-	-	-	6
19. Jack a jalopy up, George.	-	-	1	3	1	1	-	-	-	-	-	4
20. Jack got a large judge-badge.	-	-	1	2	1	-	-	-	-	-	-	4
Totals	3	10	23	31	24	10	15	15	15	4	15	14

List 3B - Balanced for High- and Mid-Vowels with Distributed Sibilants (Includes Approximants and Plosives)

Sentence	e	I	i	u	U	ɔɪ	au	s	Z	sh	3	tʃ	dʒ
1. See Sue ski asleep.	-	-	3	1	-	-	-	4	-	-	-	-	-
2. Bruce still sleeps deeply.	-	2	2	1	-	-	-	4	-	-	-	-	-
3. Swiss geese hiss loudly.	-	2	1	-	-	-	1	4	-	-	-	-	-
4. Steve keeps our suit.	-	-	2	1	-	-	1	3	-	-	-	-	-
5. You lose daisies easy.	1	1	2	2	-	-	-	-	4	-	-	-	-
6. Do boys tease zoos?.	-	-	1	2	-	1	-	-	4	-	-	-	-
7. Cows graze usual hills.	1	1	-	1	1	-	1	-	4	-	-	-	-
8. Please use our dues.	-	-	1	2	-	-	1	-	3	-	-	-	-
9. She should shear sheep.	-	1	2	-	1	-	-	-	-	4	-	-	-
10. Shelia shouted, "Push Tish!".	-	1	1	-	1	-	1	-	-	4	-	-	-
11. Shoot a shaky dish shape.	2	1	-	1	-	-	-	-	-	4	-	-	-
12. Sure she dished it.	-	2	1	-	1	-	-	-	-	3	-	-	-
13. Usual beige rouge pleasure	2	-	-	2	1	-	-	-	-	-	4	-	-
14. Pitch Rich our choice cheer.	-	3	-	-	-	1	1	-	-	-	-	4	-
15. Butch, chew cheap cheese.	-	-	2	1	1	-	-	-	-	-	-	4	-
16. Pooch, bleach each itch.	-	1	2	1	-	-	-	-	-	-	-	4	-
17. Pitch our touchy chow.	-	2	-	-	-	-	2	-	-	-	-	3	-
18. Gee, Jill ridged our jewel village.	-	3	1	1	-	-	1	-	-	-	-	-	5
19. The jury pledged Jake a judge jeep.	2	1	2	1	1	-	-	-	-	-	-	-	5
20. Be joyous Jude. Jay paged Julie.	2	1	1	2	-	1	-	-	-	-	-	-	5
Totals	10	21	24	19	7	3	9	15	15	15	4	15	15

List 3C - Balanced for Vowels

Sentence	7	I	E	æ	a	ʌ	O	U	u	3′
1. He feeds three bees.	4	-	-	-	-	-	-	-	-	-
2. She keeps either key?	4	-	-	-	-	-	-	-	-	-
3. Give Bill his pig.	-	4	-	-	-	-	-	-	-	-
4. Did Jill wish it?	-	4	-	-	-	-	-	-	-	-
5. Beth says, "Get well."	-	-	4	-	-	-	-	-	-	-
6. Let Ted help check.	-	-	4	-	-	-	-	-	-	-
7. Have Al pack a sack.	-	-	-	4	-	-	-	-	-	-
8. Has Jack that bag?	-	-	-	4	-	-	-	-	-	-
9. Paul's ball got caught.	-	-	-	-	4	-	-	-	-	-
10. Was Gar all cop?	-	-	-	-	4	-	-	-	-	-
11. Bud does love tugs.	-	-	-	-	-	4	-	-	-	-
12. Just buzz lucky Rudd?	-	-	-	-	-	4	-	-	-	-
13. Those boats go slow.	-	-	-	-	-	-	4	-	-	-
14. Joe wrote, "Throw coke?"	-	-	-	-	-	-	4	-	-	-
15. Pull Brooks hook full.	-	-	-	-	-	-	-	4	-	-
16. Could hoods look good?	-	-	-	-	-	-	-	4	-	-
17. Cool Ruth's blue boots.	-	-	-	-	-	-	-	-	4	-
18. Do you glue shoes?	-	-	-	-	-	-	-	-	4	-
19. Turk's word urged Herb.	-	-	-	-	-	-	-	-	-	4
20. Gert swirled her skirt.	-	-	-	-	-	-	-	-	-	4
Totals	8	8	8	8	8	8	8	8	8	8

Simplified Nasometric Assessment Procedures
The MacKay-Kummer SNAP Test

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Note from Kay Elemetrics Corp:

The following pages describe a test for nasometric assessment that is particularly useful when testing children, non-literate patients of all ages, and non-compliant patients. Note that normative data is not available for the SNAP Test on Nasometer II when this manual was published. However, the rationale of the SNAP Test are provided below as originally written by Drs. MacKay and Kummer, but most of the references to normative data (the actual scores) and score sheets have been removed until normative studies have been completed. References such as "compare to normative data" will be observed in guidelines below which the user will be able to perform when these studied have been completed.

NOTE: It is assumed that readers are familiar with the operation of the Nasometer. Therefore, only instructions particular to the MacKay-Kummer SNAP Test are included in this section.

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The Rationale for Development of the MacKay-Kummer SNAP Test

The Zoo Passage, the Rainbow Passage, and the Nasal Sentences are the most commonly used passages in clinical nasometry since they have been the only passages in which published normative data exists. However, use of these passages has many disadvantages in both administration and in interpretation.

The SNAP Test was developed in order to eliminate some of the problems in administration of the current standardized passages, and to improve the diagnostic value of nasometry.

The advantages of the SNAP Test over the current standardized passages are as follows:

1. The SNAP Test eliminates the requirement of literacy.

2. The SNAP Test materials are semantically, pragmatically, and lexically simple.

3. The SNAP Test materials induce few production errors and may be used with patients displaying systematic articulation/phonological errors.

4. The SNAP Test materials include subtests that are short and simple, and can be used with persons who offer little cooperation.

5. The SNAP Test allows the examiner to isolate certain phonemes or types of phonemes for assessment, which improves the diagnostic value of nasometry.

Description of the SNAP Test

The SNAP Test includes three subtests, one containing 14 syllable-repetition passages, one with 5 picture-cued passages, and one with 2 reading passages.

1. In the Syllable-Repetition Subtest (Table 5.1), consonant-vowel (CV) syllables are repeated. This test is simple and fast. A 2-second sample is used and the clinician is not required to adjust the cursors on the Nasometer display screen, no matter which version of Nasometer software is being used. (The current version of Nasometer software does not require cursor delimitation. However, earlier versions of Nasometer software require the left cursor to be on the first data point for calculation.) The Syllable-Repetition Subtest provides the greatest amount of phonetic specificity: that is, it has the fewest number of phonemes per "passage" (actually, a repeated syllable), but it has the greatest number of different passages.

2. The Picture-Cued Subtest (Table 5.2) consists of simple, repeated carrier phrases with concrete, picturable words for each passage. Pictures are used to cue the subject, reducing the memory load and improving the accuracy of production. Three sentences are produced with picture cues and then repeated, for a total of 6 sentences per passage. The Picture-Cued Subtest passages are somewhat phonetically homogeneous, focusing respectively on bilabials, alveolars, velars, sibilants, and nasals.

3. The Reading Subtest (Table 5.3) is designed for readers. It consists of two short, easy-to-read passages, one loaded with plosives and the other loaded with sibilants. The reading passages are more heterogeneous phonetically than the other two subtests, but are still more homogeneous than the "phonetically-balanced" passages that are currently used in clinical nasometry.

Administration of all the subtests is not necessary in a routine nasometric evaluation. Instead, specific passages of a subtest could be selected, depending on the patient's articulation and the diagnostic information being sought.

It is expected that the use of the SNAP Test will reduce the time and effort associated with nasometric evaluation. In many cases, four or five of the syllable-repetition passages, totaling less than 30 seconds of administration time, will provide more clinical information with a wider variety of patients than can currently be obtained using the Zoo Passage.

Administration of the SNAP Test

Prior to the administration of a SNAP Test, it is assumed that:

1. The Contour mode (called the TIME HISTORY in earlier versions of the Nasometer software) has been selected

2. The Averaging function has been turned on (this is the default setting in the new software; the old software required this as a separate step), and

3. The headset has been put in place on the patient.

It is appropriate to select the initial passages for use first. Additional passages can be selected later, depending upon the results obtained in the initial testing.

Test 1 - The Syllable-Repetition Subtest (Table 4.1)

1. Select Display, then "Set Display Duration" and the 2-second Time Axis for the Contour display. (For earlier software versions, note that you must select the 2-second TIME AXIS for the TIME HISTORY display.)

2. Ask the patient to repeat the test syllable at a "normal" speed until the screen is full of relatively even peaks. Either model the speed, or ask the patient to repeat in time with the flashing timer light, which the newest version of the Nasometer software will optionally display. Approximately 6–10 syllables should be produced during the 2-second period. The articulation should not be so fast as to be slurred, nor so slow as to be unnaturally deliberate.

3. Press F12 to activate data acquisition. (In earlier versions of the software, data acquisition is started and stopped with the spacebar.)

4. When the Contour display is full of even peaks, and the first couple of syllables have disappeared to the left, press ENTER to stop data acquisition. It is unimportant whether the syllables displayed have been cut or are displayed whole.

5. Select Analysis, then "Displayed Data". (In earlier versions of the software, engage the CALCULATE function directly, without setting the cursors.)

6. Obtain the nasalance score from the Nasometer screen and record it on the score sheet (Table 5.4).

7. Compare with the norms, and repeat measures where anomalous scores are obtained.

8. Press F2 to clear the screen of all data before proceeding to the next task. (In earlier versions of Nasometer software, the screen is cleared by SCREEN CLEAR.)

Test 2 - The Picture-Cued Subtest (Table 4.2)

There are 5 passages in the Picture-Cued Subtest. Each passage is made up of 3 different sentences using a carrier phrase, and each sentence is said twice, making 6 sentences per passage. The carrier phrase is written, and pictures of the three items cue the completion of each sentence. Pointing to the pictures in the appropriate sequence may help to cue the child.

The clinician may make use of printed copies of the pictures or may use the images built into the most recent version of the Nasometer software so that they may be displayed on the computer screen. The sentences could also be printed out if the patient is a reader.

In general, this test follows the normal procedures for nasometry:

1. Select **Options**, then "Select Nasometer Options" to display a Nasometer Setup dialog box. From the Display tab, set the window to Contour display mode with a 12-second display duration on the time axis. Click APPLY to apply these settings to the Nasometer data window.

2. Go over the desired passage with the patient until the patient clearly understands the task.

3. Press F12 to start data acquisition.

4. Ask the patient to begin producing the carrier phrase sentences.

5. Continue to cue the patient by showing or pointing to the appropriate pictures. Do this at a pace such that the production of the sentences represents a coherent passage without long silences.

6. When the patient has finished producing all 6 sentences of the subtest, press ENTER to stop data acquisition.

7. If sounds or extraneous words are present at the beginning or the end of the passage, they can be edited out using the **Trim Portions of Signal** options under the **Edit** menu. If extraneous sounds occur in the middle of the passage, these should be edited out by selecting the contour of the extraneous sounds, then using the Trim feature **Remove Signal in Selection**. Refer to the Nasometer on-line Help documentation for more information about selecting a range of data and trimming data.

8. You may select a range of data for analysis, or you may display nasalance information for all of the data. After data acquisition is halted, all of the data are selected by default. If a smaller range of data was subsequently selected, you may re-select all the data by choosing **Select All Data** from the **View** menu.

9. From the **Analyze** menu, select **Compute Result Statistics** to display the Nasometer Statistics box. Statistics are reported only for the selected region of the data.

10. Obtain the patient's nasalance score ("Mean %") from the top of the displayed Nasometer Statistics box and record it on the score sheet (Table 4.4).

11. Compare the score with the norms, and repeat measures where anomalous scores are obtained.

12. Press F2 to clear the screen of all data before proceeding to the next task.

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Test 3 - The Reading Passages Subtest (Table 4.3)

There are two different reading passages provided in the Reading Passages Subtest. Each one may be used separately with patients who are accomplished readers.

1. Select **Options**, then **Select Nasometer Options** to display a Nasometer Setup dialog box. From the Display tab, set the window to Contour display mode with a 20-second display duration on the time axis. Click APPLY to apply these settings to the Nasometer data window.

2. Have the patient read the passage aloud, including the title, at least once to practice.

3. Press F12 to start data acquisition.

4. Ask the patient to begin reading.

5. When the patient has finished, press ENTER to stop data acquisition.

6. If sounds or extraneous words are present at the beginning or the end of the passage, they can be edited out using the **Trim Portions of Signal** options under the **Edit** menu. If extraneous sounds occur in the middle of the passage, these should be edited out by selecting the contour of the extraneous sounds, then using the Trim feature **Remove Signal in Selection**. Refer to the Nasometer on-line help documentation for more information about selecting a range of data and trimming data.

7. You may select a range of data for analysis, or you may display nasalance information for all of the data. After data acquisition is halted, all of the data are selected by default. If a smaller range of data was subsequently selected, you may re-select all the data by choosing **Select All Data** from the **View** menu.

8. From the **Analyze** menu, select **Compute Result Statistics** to display the Nasometer Statistics box. Statistics are reported only for the selected region of the data.

9. Obtain the patient's nasalance score ("Mean %") from the top of the displayed Nasometer Statistics box and record it on the score sheet (Table 5.4).

10. Compare with the norms, and repeat measures where anomalous scores are obtained.

11. Press F2 to clear the screen of all data before proceeding to the next task.

General Guidelines

In choosing subtests or specific passages for assessment, the following guidelines should be kept in mind:

1. Do not use a reading passage unless the patient can read without unnatural hesitations, revisions, and production errors.

2. Do not use a picture-cued passage unless the patient can produce it without basic errors in the production task, or serious delays, revisions, or production errors.

3. Do not use a passage of any subtest that is beyond the patient's phonological competence.

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SNAP Test References

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The MacKay-Kummer SNAP Test

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Table 4.1 - Syllable-Repetition Subtest

Subtest 1

Administration	Passage	Text of Passage
Syllable Repetition	A	pa pa pa...
	B	pi pi pi...
	C	ta ta ta...
	D	ti ti ti...
	E	ka ka ka...
	F	ki ki ki...
	G	sa sa sa..
	H	si si si...
	I	ʃa ʃa ʃa...
	J	ʃi ʃi ʃi...
	K	ma ma ma...
	L	mi mi mi...
	M	na na na...
	N	ni ni ni...

NOTE: The syllables have been written in phonetic script. The vowels a and i represent their IPAA (International Phonetic Association Alphabet) values, with a representing the vowel of the expression "ah" and i representing the vowel of the word "see." The consonants have their expected values; the "sh" sound is represented phonetically as [ʃ].

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Table 4.2 - Picture-Cued Subtest

Subtest 2

Administration	Passage	Text of Passage
Cued by pictures and preliminary coaching.	A	Pick up the book. Pick up the pie. Pick up the baby. Pick up the book. Pick up the pie. Pick up the baby.
	B	Take a turtle. Take a tire. Take a teddy bear. Take a turtle. Take a tire. Take a teddy bear.
	C	Go get a cookie. Go get a car. Go get a cake. Go get a cookie. Go get a car. Go get a cake.
	D	Suzy sees the scissors. Suzy sees the horse. Suzy sees the dress. Suzy sees the scissors. Suzy sees the horse. Suzy sees the dress.
	E	Mama made some mittens. Mama made some muffins. Mama made some lemonade. Mama made some mittens. Mama made some muffins. Mama made some lemonade.

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Subtest 2 - Picture-Cued Passage A

Pick up the....

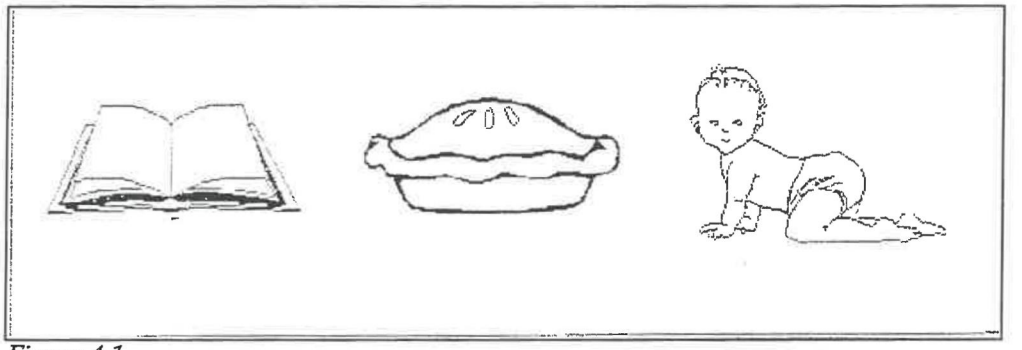

Figure 4.1

(Say each phrase twice.)

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Subtest 2 - Picture-Cued Passage B

Take a...

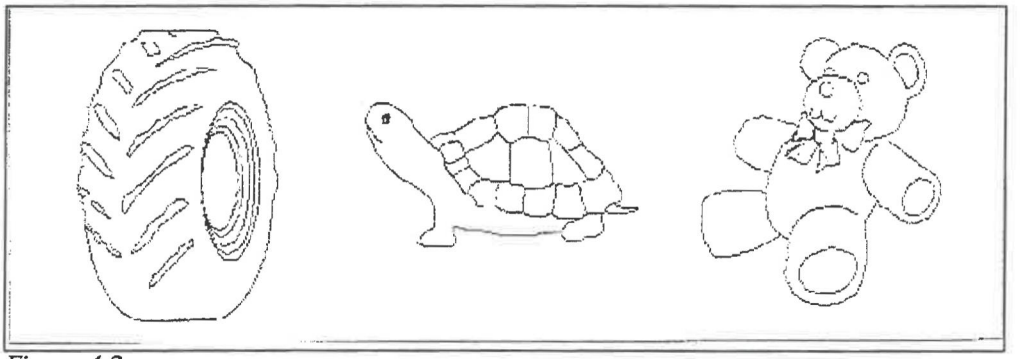

Figure 4.2

(Say each phrase twice.)

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Subtest 2 - Picture-Cued Passage C

Go get a...

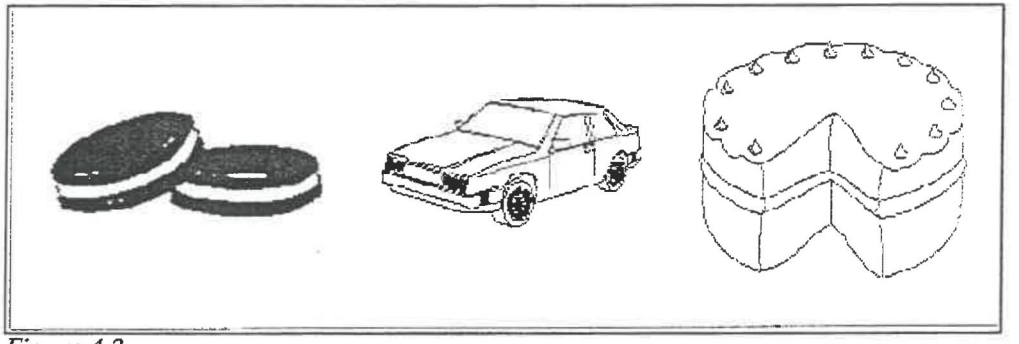

Figure 4.3

(Say each phrase twice.)

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Subtest 2 - Picture-Cued Passage D

Suzy sees the...

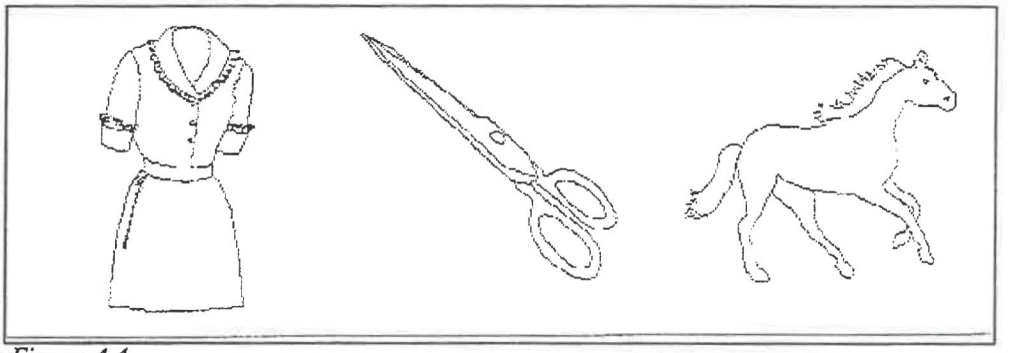

Figure 4.4

(Say each phrase twice.)

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Subtest 2 - Picture-Cued Passage E

Mama made some...

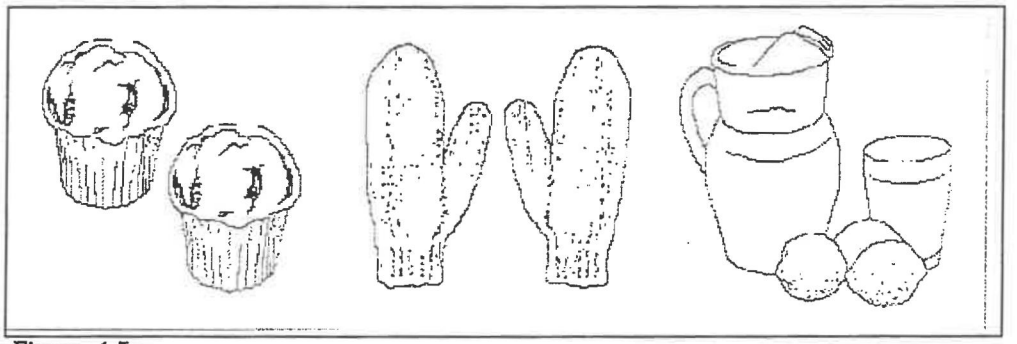

Figure 4.5

(Say each phrase twice.)

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Table 4.3 - Reading Passages Subtest

Subtest 3

Administration	Passage	Text of Passage
Reading passage for literate subjects. The title of the passage (shown in third column of this table) is read along with the text.	A. Ball Passage	Bobby and Billy Play Ball Bobby and Billy go to play ball. They get a bat, a ball, and a glove. They go to the ball park. Billy took a turn at bat. Bobby tried to throw the ball. Billy hit the ball up high. Bobby and Billy like to play ball.
	B. Suzy Passage	A School Day for Suzy Suzy eats cereal or toast for breakfast. After that, she rides the bus to school. Suzy likes to sit with Sally. At school, the teacher gives Suzy's class a test. Suzy likes her school. She also likes her teacher.

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Subtest 3 - Reading Passage A

Instructions: Read the title with the passage.

Bobby and Billy Play Ball

Bobby and Billy go to play ball.
They get a bat, a ball, and a glove.
They go to the ball park.
Billy took a turn at bat.
Bobby tried to throw the ball.
Billy hit the ball up high.
Bobby and Billy like to play ball.

Figure 4.6

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Simplified Nasometric Assessment Procedures
The MacKay-Kummer SNAP Test

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Subtest 3 - Reading Passage B

Instructions: Read the title with the passage.

A School Day for Suzy

Suzy eats cereal or toast for breakfast.
After that, she rides the bus to school.
Suzy likes to sit with Sally.
At school, the teacher gives Suzy's class a test.
Suzy likes her school.
She also likes her teacher.

Figure 4.7

Chapter 5 - Reference Commands

Program Reference

Nasometer II Toolbar

Button	Description
	Purges the active window, then calls a dialog box that allows selection of a signal file to open. Extracts Nasometer II results from the opened file into the Nasometer II window.
	Calls a dialog box, which allows you to save the signal portion of the Nasometer II results in the active window to an audio file.
	Starts the real-time Nasometer II data capture routine.
	Generates audio output of all Nasometer II signal data in the active window.
	Computes and displays numerical results for all Nasometer II data in the active window.
	Computes and displays result statistics for the selected Nasometer II data in the active window.
	Changes the pen color from its current setting to the next color in the list of available pen colors.
	Clears the active window and removes any associated data.
	Opens Nasometer II Help.

Nasometer II Pre-Defined Keys

The table below lists the keys defined in the Nasometer II menu, called menu hot keys. The user may not change these key definitions. To use these pre-defined keys, the Nasometer II data window must be active. If the Stimulus Display window is active, these function keys cannot be used.

Hot Key	Menu Item	Description
F1	Help, Open Help	Opens Nasometer II Help document.
F2	Edit, Clear Nasometer Window	Purges signal and Nasalance data from Nasometer II window.
F3	Speak, Speak All	Starts audio output of all signal data in Nasometer II window.
F4	Speak, Speak Selected	Starts audio output of signal data in selected region in Nasometer II window.
F5	File, Open File and Analyze	Opens 2-channel Nasometer II signal file, then computes Nasalance results in Nasometer II window.
Alt+F5	File, Open Nasalance Results File	Opens a Nasalance results file, for display in Nasometer II window.
Ctrl+F5	File, Open DOS Nasalance Results File	Opens a Nasalance results file from NM2 DOS program, for display in Nasometer II window.
F6	File, Save Signal Data	Saves 2-channel Nasometer II signal to a file, with Nasalance contour optionally saved to Channel 3.
F7	Stimulus, Open Stimulus Window	Opens the Stimulus Display window if it has been closed.
F8	Stimulus, Display Sprite	Displays a graphic image across the screen
F12	File, New (Record)	Records a signal from the Nasometer II headset and computes nasalance results in the Nasometer II window.
Ctrl+C	Edit, Copy Signal to Temp File	Saves signal portion in the active window to a temporary file.
Ctrl+N	Analyze, Produce Numerical Results	Displays Numerical Results for all data in Nasometer II window, with print/save options.

Hot Key	Menu Item	Description
Ctrl+R	Options, Select Nasometer Options	Accesses dialog box for selecting Nasometer II parameters.
Ctrl+S	Analyze, Compute Result Statistics	Computes and displays stats for selected results in Nasometer II window, with print/save options.
Ctrl+V	Edit, Paste Signal from Temp File	Retrieves temporary file with signals in Channels 1 and 2, then computes nasalance data in Nasometer II window.
-	View, Select All Data	Moves selection edges to start and end of Nasalance contour.
+	View, Select Displayed Data	Moves selection edges to start and end of currently displayed Nasalance contour.
[	View, Scroll Left	In Contour mode, scrolls Nasalance contour 10 pixels to the left of the current display in the Nasometer II window.
]	View, Scroll Right	In Contour mode, scrolls Nasalance contour 10 pixels to the right of the current display in the Nasometer II window.
Ctrl+	View, Page Left	In Contour mode, scrolls Nasalance contour to the left.
Ctrl+	View, Page Right	In Contour mode, scrolls Nasalance contour to the right.
Shift+Del	View, Remove Selection Cursors	In Contour mode, removes selection cursors from the data in active window.

Accessing Nasometer II Commands

There are three ways for the user to access the Nasometer II program commands: the pull-down menus, the pre-defined keys, and the command line. Pre-defined keys and pull-down menus are the most user friendly, though the command line offers the most versatility. However, the use of the command line requires the user to know and enter proper syntax for each command and command parameter.

Please note that the Nasometer II command line cannot be used if the Stimulus Display Window is active. Activate the Nasometer II data window by clicking on its title bar before using this program feature.

After executing a command using the menu, the toolbar or a pre-defined key combination, you may press BACKSPACE to observe the command that was just executed. This is a useful feature to help you familiarize yourself with the commands.

Once you become familiar with the commands, you may execute them from the command line using the keyboard. To access the command line, press the SPACEBAR. Then type the name of the command that you want to execute, and press ENTER.

An advantage of a command-driven structure is that macros may be created, consisting of a sequence of commands to perform a series of operations, such as data loading, analyzing, and editing. The program initialization file is a macro that is executed upon program startup.

Note that if the active window is initialized for Nasometer II functions, all commands prefaced with "NSM" can be issued with or without the "NSM" at the beginning, with the exception of NSM INIT. For example, the NSM CAPTURE command can be executed by simply typing CAPTURE on the command line if the active window is initialized for Nasometer II functions.

Commands and Command Parameters

A command is a string of alphabetic characters that is recognized by the program as a request to execute some legitimate operation within the program's command structure.

A command parameter is an alphabetic or numeric value or variable that follows a command. The command parameter specifies the manner in which the command is to be executed, where data are to be accessed, where results are to be placed, what specific components of data are to be operated on, or a combination of the above.

The following conditions apply to commands and command parameters:

1. Commands and command parameters are not case sensitive: an entry may be made in upper or lower case.

2. When stacking several commands together before entry (i.e., for sequential command execution), the commands MUST be separated by a semicolon (;).

3. Command parameters must be separated by at least one space.

4. Stacked commands, including their command parameters, are not sensitive to the presence or number of spaces separating them.

Command Parameter Syntax and Symbols

Commands that perform the functions of displaying, analyzing, speaking or editing data in a window use the following command syntax:

COMMAND *source location*

or

COMMAND *source range*

Commands that do not use this syntax are explained as they are presented in the individual command descriptions. The parameters *source*, *location*, and *range* are explained below, followed by the symbols that are used by each of these parameters.

1. *Source*: The waveform data source, specified by one of the following symbols:

=	The active window, or the waveform data source associated with the active window.
!	The default source window.
A to Z	A letter used to identify the source window.

Normally, there is only one Nasometer II data window open in the work area, Window A. This window will be both the active window and the default source window for program operations.

2. *Location*: Any waveform data point specified by one of the following symbols, or specified by one of the following symbols followed by an offset:

=	The current data cursor position.
0	The first or leftmost data point.
*	The last or rightmost data point.
ss	The start of the selection area in the data.
se	The end of the selection area in the data.
<	The first or leftmost data point currently displayed.
>	The last or rightmost data point currently displayed.
d	A numerical value (without decimal) representing a point in the data, where 0 is the first data point.
d.d	A numerical value (including decimal) representing a location in units displayed along the x-axis. This could be seconds, milliseconds or Hertz.
location +/-*d*	A positive or negative offset, in data points, from a data point identified by one of the above *location* symbols.

location* +/-*d.d	A positive or negative offset of time from a data point identified by one of the above *location* symbols.
***location* +/-#**	A positive or negative offset of time from a data point identified by one of the above location symbols, where # represents the currently displayed time range. For example, if 0.1 seconds of data are currently displayed, =+# represents a point 0.1 seconds to the right of the current cursor location.
***location* +/-*d*P**	A positive or negative offset, in pixels, from a data point identified by one of the above *location* symbols. This is only valid if movement to another pixel would encapsulate more than one sampled data point or value. When zoomed in on a display, the cursor will move to the next value, not the next pixel.

3. *Range*: A *range* is any *location* followed by another *location* that has a value that is greater than the value of the first *location*. Note that if the Nasometer II data window is set to Contour display mode, a *range* may be specified using any valid *location* symbols. If the Nasometer II data window is set to Bar or Empty display mode, the *range* must be specified using time values in seconds; otherwise, the specified *range* is ignored and the program operates on all of the data.

ATTACH STIMULUS

Command to display a user interface dialog box for a task module.

Syntax: **ATTACH STIMULUS**

When the ATTACH STIMULUS command is executed, the Stimulus Display window is displayed on the screen. The stimulus file last loaded using NSM LOAD.STIMULUS is displayed in the window, or the display is blank if no file was previously loaded (e.g., if the window was purged).

From the attached Stimulus Display window, the user may click on the following buttons to perform program operations:

LOAD -	Display an existing stimulus file. Either Picture Stimulus files (.BMP) or Text Stimulus files (.STM) may be displayed in the box.
PURGE -	Close the open stimulus file.
CLOSE -	Close the Stimulus Display window.
ENABLE EDIT -	Create a new or edit an existing Text Stimulus file. When in edit mode, the ENABLE EDIT becomes a DISABLE EDIT button.
SAVE -	Save the new or edited Text Stimulus file, created when in edit mode.

The size of the text is determined by the setting for SET STIMULUS.FONT. Use the DETACH STIMULUS command to close the dialog box.

DEFINE

Command to define a key on the keyboard to execute a program command.

Syntax: **DEFINE** *key command*

DEFINE returns a dialog box, requesting the selection or entry of the key to be defined. When the key or key combination is entered, the current key definition is displayed. If the key is definable, you may enter a sequence of commands on the key definition line, separating each command by a semicolon (;). Note that a command parameter must be separated from its command by a space. It is not necessary to enter a space before or after the semicolon. You may also enter textual information in the help field, which is displayed on the status bar after the defined key is pressed. The key definition is completed by clicking APPLY. Click DONE when you have finished defining keys.

As mentioned above, if the key you select has already been defined, the current definition is displayed. Keys that are not defined in the menu may be changed using simple line editing techniques. Most keys on the keyboard may be defined. Exceptions include the ESC, ENTER, BACKSPACE, PRINT SCREEN, SCROLL LOCK, PAUSE, NUM LOCK and SPACEBAR keys.

Alternatively, you may enter the key class, key name and key definition on the command line. In this case, the command string should be placed between quotation marks ("), and any previously existing key definition will not be displayed. An error message is displayed if you try to redefine a key that is defined in the menu.

In the initialization file, Insert is defined to execute the DEFINE command.

DETACH STIMULUS

Command to close an open user interface box.

Syntax: **DETACH STIMULUS**

Use the ATTACH STIMULUS command to display a Stimulus Display Window. To remove the box from screen, use the DETACH STIMULUS command.

EXIT

Command to exit the program.

Syntax: **EXIT**

An information box is displayed, in which confirmation to exit the program is requested. Using the mouse to select NO will return the user to normal program operations. Using the mouse to select YES or pressing ENTER will cause the environment to be reset from graphics mode and the program to be terminated.

This command is the same as QUIT.

MACRO

Create a command file while executing program commands, by setting the program into a mode that records all subsequent commands that are executed. Note that you cannot embed a call to run a macro on the command line.

Syntax: **MACRO** LEARN *filename*

MACRO DISPLAY

MACRO HIDE

MACRO UNDO

MACRO SAVE *filename*

MACRO EXIT

MACRO RUN *filename*

filename is the name of a command file.

The MACRO command allows you to create a command file by recording into it all commands and command parameters that are executed subsequent to the MACRO command, while these commands are being executed. Note that commands may be entered into the command file under macro mode in any manner available, including entering commands on the command line, executing commands using the mouse and menus, and executing commands by using pre-defined keys. The command file that is created is a text file that contains a list of program commands, which may later be sequentially executed by running the macro.

MACRO LEARN *filename* creates a command file by recording all commands (with the exception of macro commands) and command parameters subsequently executed in a text file. (Commands executed using a window Control menu are not recorded.) You may specify a *filename* for the command file when you begin recording the macro, or when you save the command file to disk. To display a message to the user when the macro is run, enter the MESSAGE command on the command line when recording a macro.

MACRO DISPLAY displays a macro dialog box that contains a list of all commands in the macro. There are also buttons inside the box which allow you to execute macro commands, such as hiding the macro dialog box, removing commands from the command file, and exiting macro mode (with or without first saving the command file to disk). If the command file has been named, the *filename* appears at the top of the dialog box.

MACRO HIDE removes the display of the macro dialog box from the work area. You may also click HIDE within the macro dialog box.

MACRO UNDO removes the last command issued for storage in a command file using the MACRO LEARN command. If the last command entered was incorrectly specified, it may be deleted from the command sequence being stored in a command file by entering the MACRO UNDO command. Alternatively, if MACRO DISPLAY has been used to display the macro dialog box, you may select a command from anywhere within the list of macro commands and remove it by selecting UNDO. Note that after removing a command from the command file, the program stays in macro mode so that subsequent commands can be entered to complete the desired command file sequence.

MACRO SAVE *filename* is used to save the command file to disk for later execution using MACRO RUN. If the macro file was not named when you entered macro mode, a prompt box appears requesting selection of the directory for storage of the command file and entry of a file name. Also, a name entered when entering macro mode may be changed when you save the command file to a new *filename*. Macro files are given a .MAC extension by the program.

MACRO EXIT quits macro learn mode. If changes have been made to the macro file, you will be warned that the macro has not been saved, and asked if you wish to save it before exiting. Select YES to save the macro and exit or NO to exit without saving. Select CANCEL to return to macro learn mode.

MACRO RUN *filename* is used to execute a command file stored on disk. If *filename* is not specified, a dialog box appears which allows selection of the command file. A command file is any text file that contains a list of program commands. These commands are executed in the order that they appear in the command file.

If a command in the command file is invalid, the program will display an error message. The user then has the option of terminating command file execution at the stage that the error was detected or of continuing with the remaining commands.

MESSAGE

Command that allows you to program the display of a message box containing a text string for a specified length of time. This command is designed to be used when writing macros, to allow the display of messages to the user during macro execution.

Syntax: **MESSAGE** *seconds text*

seconds is a number between 0 and 30, inclusive, which specifies the number of seconds to display the message box.

text is the message to display in the message box

The MESSAGE command allows you to display messages to the user for a specified length of time from within a macro. If the command is executed from the command line, an OK button is displayed in the message box along with the text of the message. If executed from within a macro, the text is followed by two buttons, CANCEL and OK.

The maximum length of *text* is approximately 110 characters. *Text* may include alphanumeric characters as well as commas and periods. Note that the message cannot begin with a number, as a number at the start of the *text* is interpreted as a specified length of time, in seconds, to display the message. If *seconds* is not specified or if *seconds* is set to 0, the message box will remain on the screen until OK is clicked. If *seconds* is greater than 30, an error message is displayed.

MOVE

Command to move the data cursor in the Nasometer II data window to a specified *location*. Note that the window must be set to Contour display mode.

Syntax: **MOVE** *location*

The data cursor is moved from its current location to the specified *location* in the Nasometer II data window. Note that the window must contain nasalance results displayed in Contour display mode (see SET NSM.DISPLAY.MODE), or the data cursor is not available. If *location* is not within the range of the displayed data in the active window, the data cursor is placed at the end of the window nearest the requested point.

If a scroll bar is displayed in the window, the red indicator above the scroll bar is updated to reflect the new location of the data cursor.

NSM ANALYSE

Command to compute the nasalance results for a range of waveform data in the specified window. The resulting nasalance data are displayed in the active window.

Syntax: **NSM ANALYSE** *label range*

label is a window identifying letter

Use NSM ANALYSE to compute nasalance results from existing sampled data. The specified *range* of data in the window identified by *label* is analyzed, and the resulting nasalance results are displayed in the active window according to the settings for the Nasometer II display options: NSM.DISPLAY.MODE, NSM.DISPLAY.FILL, NSM.DISPLAY.INVERT and NSM.DISPLAY.AVERAGING.

The waveform data must be stereo data, with signal data in channels 1 and 2. The sampling rate of both channels must be equal to the rate set in the Nasometer II configuration. It is assumed that the nasal data is stored in channel 1, and the oral data is in channel 2.

NSM.ANALYSIS.DURATION

Specifies the maximum length, in seconds, of captured NSM data to store.

Syntax: **SET NSM.ANALYSIS.DURATION** *duration*

duration is an integer in the range 1 to 100, inclusive, representing a number of seconds

NSM.ANALYSIS.DURATION allows you to set the maximum size of the data capture buffer for storage of signal data as well as nasalance results during NSM operations. The value of *duration* is given in seconds. When *duration* is not specified, the Nasometer II Setup box is displayed. On the Analysis tab, enter a new duration by typing a time value into the Analysis Duration edit box or by using the slider control.

If NSM.SINGLE.PASS has been used to set the program to single-pass capture mode, then the capture operation stops automatically once the data buffer is full; otherwise, capture continues indefinitely, with the data at the start of the buffer being overwritten by new data until the capture routine is manually halted. If data appending is turned on using NSM.DATA.APPEND, appending new data may cause earlier data to be removed from memory if the total duration of captured data exceeds the set analysis duration, unless the program is set to single-pass mode.

The NSM.ANALYSIS.DURATION command is intended to establish the maximum length of NSM data that is captured. The command does not change the duration of NSM data that is displayed when in Contour mode (see NSM.DISPLAY.MODE), which is set by NSM.DISPLAY.DURATION.

NSM.AUDIO.MODE

Specifies either stereo or mono audio output during playback of the data.

Syntax: **SET NSM.AUDIO.MODE** *MONO| STEREO*

STEREO specifies stereo output of the two audio channels, oral and nasal

MONO specifies mono output of one of the audio channels, either oral or nasal

NSM.AUDIO.MODE enables the selection of stereo output of the two audio channels, or mono output of one of the audio channels. If STEREO output is selected, the nasal signal is sent to channel 1 output (left) and the oral signal is sent to channel 2 output (right). If MONO is selected, then audio output of the selected channel is passed to both speakers. The mono channel is specified using the NSM.MONO.CHANNEL command.

If no setting is specified, the Nasometer II Setup box is displayed. On the Playback tab, click the Mono or Stereo radio button in the Audio Mode group to select the desired audio output mode. After changing the setting, you may click APPLY in the Nasometer II Setup box to apply the new setting to the active NSM data window. Note that you cannot change the setting for an existing NSM window from the command.

During audio output, the Nasometer II window is updated in time with audio output when NSM.DISPLAY.MODE is set to either CONTOUR or BAR.

NSM.AUDIO.OUTPUT

Specifies either filtered or unfiltered audio output during playback of the data.

Syntax: **SET NSM.AUDIO.OUTPUT** *FILTERED*| *UNFILTERED*

FILTERED - the audio signal is passed through a digital filter during playback

UNFILTERED - the unfiltered audio signal is played

An FIR filter is implemented in high level during data capture, to enable real-time processing of the two audio signals upon input. The nasalance ratio is computed from the filtered signal. For audio monitoring and signal file saving purposes, the unfiltered stereo signal is held in memory.

Using NSM.AUDIO.OUTPUT, the user can select whether to listen to the audio signal in its FILTERED or UNFILTERED format. If the FILTERED format is chosen, the signal is passed through the digital filter while it is being passed to audio output.

If no setting is specified, the Nasometer II Setup box is displayed. On the Playback tab, click the Filtered or Unfiltered radio button in the Audio Output group to select the desired audio signal to monitor. After changing the setting, you may click APPLY in the Nasometer II Setup box to apply the new setting to the active NSM data window. Note that you cannot change the setting for an existing NSM window from the command.

NSM CALIBRATE

Command to start the Nasometer II calibration routine.

Syntax: **NSM CALIBRATE**

Calibration of the Nasometer II is necessary for accurate data collection and analysis. The instrument is calibrated by presenting a series of pulses to the oral and nasal microphones on the headset. The calibration routine assumes that the input levels on Channel 1 (nasal) and Channel 2 (oral) are the same (i.e., balanced).

After unpacking the instrument, the Nasometer II should be checked for calibration. Once calibrated, the Nasometer II should still be checked at regular intervals to ensure the validity of the collected data. Actual calibration adjustments should not be required often. Checking the instrument's calibration takes only a few minutes.

To perform the calibration, the Nasometer II headset should be correctly positioned in the mounting bracket of the Nasometer II external hardware box, to guarantee accuracy. After properly positioning the Nasometer II and the headset, enter the Nasometer II program and use NSM CALIBRATE to continue with the calibration procedure. A blue progress meter is displayed in the application window status bar, and a message box reports "Calibrating Nasometer input audio...".

Press Calibrate on the front of the Nasometer II external hardware box to begin generating a series of pulses. These pulses are directed from the speaker on the top of hardware box toward the Nasometer II headset that is mounted on the hardware box.

After a short time, an Audio Calibration message box is displayed, reporting the new calibration value. Typical values are in the range 0.9 to 1.1. You may now press Calibrate on the front of the Nasometer II external hardware box to turn off the pulses.

In the Audio Calibration message box, click OK to close the box and save the calculated value. When the calibration value is saved, it is written into the computer registry file, where it is accessed by the Nasometer II program each time it is run.

NSM CAPTURE

Command to initiate the capture and processing of real-time nasalance data.

Syntax: **NSM CAPTURE**

The NSM CAPTURE command starts the capture and processing of the real time nasalance measure in the active Nasometer II window. The window may be empty or may contain NSM data prior to command execution. If you start capturing into a window that contains NSM data, the existing data are either overwritten or appended to, depending on the setting for NSM.DATA.APPEND.

Real-time capture and processing is indicated by the display of two VU meters in the active window status bar, one above the other. The top meter reports the nasal energy and the bottom meter reports the oral energy. These meters indicate if the subject is speaking too loudly or emitting too much nasal energy. These meters should show green most of the time during signal input, with higher volume peaks being indicated by yellow. VU meter levels that are becoming too high (overdriven) are shown as red. The nasalance ratio for the input signal is calculated and displayed in real time on the status bar to the right of the progress meters. Depending on the setting for NSM.DISPLAY.MODE, the nasalance data may also be displayed in the active window in real time.

When the NSM CAPTURE command is executed, a circular buffer is initialized, the size of which is specified by NSM.ANALYSIS.DURATION, to a maximum of 100 seconds duration. Except when NSM.SINGLE.PASS is set to TRUE, data capture will continue indefinitely, always holding the last data in memory. If capture continues longer than the set duration, the data at the beginning of the capture buffer are overwritten with the new data. When data are being appended (see NSM.DATA.APPEND), the set analysis duration applies to the total duration of all data.

The capture operation is terminated by pressing ENTER, ESC or the SPACEBAR. Optionally, Single Pass capture mode may be selected using the NSM.SINGLE.PASS command. In this case, data capture will continue for the length of time set by NSM.ANALYSIS.DURATION and then stop automatically, eliminating the need for manual input from the user. After data capture terminates, the active window displays the last data captured, to a maximum duration specified by NSM.DISPLAY.DURATION.

NSM.CH3

Specifies whether to save the nasalance contour to Channel 3 of an NSP file.

Syntax: **SET NSM.CH3** *TRUE* | *FALSE*

When a file is saved, you may save the calculated nasalance values as a trace in the third channel, so that this trace can be loaded and displayed in other application.

If NSM.CH3 is set to *TRUE,* the option of saving the nasalance trace to Channel 3 of the NSP audio file is presented to the user.

If NSM.CH3 is set to *FALSE,* the nasalance trace is not saved.

NSM CLEAR

Command to clear all Nasalance data from the Nasometer II window, and clear any associated signal data in the data capture buffer.

Syntax: **NSM CLEAR** *YES*

When the NSM CLEAR command is executed, a box displays a warning that all data in the specified window are about to be removed from program memory, and waits for confirmation to continue the operation. Select YES to clear the window, or select NO to cancel the operation.

To clear the data in the Nasometer II window without displaying a warning message, use the command NSM CLEAR YES, where YES instructs the program to clear the data without waiting for confirmation.

NSM.DATA.APPEND

Specifies whether captured data will replace or be appended to the end of existing NSM data in the active window during real-time capture and processing.

Syntax: **SET NSM.DATA.APPEND** *TRUE| FALSE*

The NSM.DATA.APPEND command tells the program whether to append the new data to the end of the existing NSM data, or whether to clear existing data before new data are captured using NSM CAPTURE. If the setting is not specified on the command line, the Nasometer II Setup box is displayed. On the Analysis tab, enable the Data Appending checkbox if you want data appending, or clear the checkbox if you do not want data appending. After changing the setting, you may click APPLY in the Nasometer II Setup box to apply the new setting to the active NSM data window. Note that you cannot change the setting for an existing NSM window from the command.

When NSM data are appended, the program behaves as if input was never halted. The existing data are not re-analyzed, and silence is not added at the boundary.

The maximum size of the NSM capture buffer is set by NSM.ANALYSIS.DURATION. If data appending is turned on, you could overwrite the data at the beginning of the capture buffer unless the program is set to single-pass mode using NSM.SINGLE.PASS.

You cannot append to existing data in the window that was acquired using NSM LOAD.NAS or NSM LOAD.RESULTS.

NSM.DISPLAY.AVERAGING

Optionally applies averaging (smoothing) of the computed nasalance ratio across a specified number of adjacent frames.

Syntax: **SET NSM.DISPLAY.AVERAGING** *n*

n is an integer in the range 1 to 12, representing the number of frames of data to average. If *n* is set to 1, no averaging is applied.

The NSM.DISPLAY.AVERAGING command offers a display feature that smoothes the data so that irregular points of nasalance are smoothed into a general contour. The averaging function uses a moving average approach to compute the averaged nasalance ratio for the current frame, *f*. Frame *f* is the last frame in the array of *n* frames, where *n* is in the range 1 to 12. Note that averaging is only applied to the display of Nasalance data (contour or bar), and not to the actual numerical results. Therefore, applying averaging does not affect statistical analysis calculations.

The nasalance values of *n* frames are averaged and the result is assigned to frame *f*, as follows:

The number of frames in the array of *n* frames with non-zero values are counted.

If the number of frames with non-zero values is less than or equal to half of *n*, then the value zero (0) is returned for the current frame *f*.

If the number of frames with non-zero values is greater than half of *n*, the values for the *n* frames are added. This sum is then divided by the number of frames in the array with non-zero values, and the result is assigned to the current frame *f*.

For example, if *n* is set to 4 and the values for the four frames of data up to and including the current frame *f* are 5, 0, 0 and 5, then *f* is assigned the value of 0, since only half the frames have non-zero values. If the values are 5, 5, 0 and 5, then *f* is assigned the value (5+5+5)/3 = 5, where 3 is the number of frames having non-zero values in the array.

Following processing for frame *f*, the process is repeated for frame *f+1*, etc., to obtain the smoothed contour.

If the setting is not specified on the command line, the Nasometer II Setup box is displayed. On the Display tab, enter a new value in the Display Averaging edit box, or use the spinner control to increase or decrease the displayed value. After changing the setting, you may click APPLY in the Nasometer II Setup box to apply the new setting to the active NSM data window. Note that you cannot change the setting for an existing NSM window from the command.

NSM.DISPLAY.DURATION

Specifies the length, in seconds, of the data to display in the Nasometer II data window when in Contour mode.

Syntax: **SET NSM.DISPLAY.DURATION** *duration*

duration is an integer in the range 1 to 100, inclusive, representing a length of time, in seconds

NSM.DISPLAY.DURATION establishes the length of nasalance data to be displayed across the window when in Contour mode. The value *duration* is given in seconds (and is reported along the bottom of the window).

If *duration* is not specified, the Nasometer II Setup box is displayed. On the Display tab, enter a new duration by typing a time value into the Display Duration edit box or by using the slider control. After changing the setting, you may click APPLY in the Nasometer II Setup box to display the new length of data in the active Nasometer II data window. Note that you cannot change the setting for an existing NSM window from the command.

The NSM.DISPLAY.DURATION command is intended to establish the length of the NSM data that is displayed during and after data capture, when the window is set to Contour display mode (see NSM.DISPLAY.MODE). The command does not change the total duration of NSM data that can be captured or loaded and held in program memory, which is set by NSM.ANALYSIS.DURATION.

NSM.DISPLAY.FILL

Specifies whether the area below the Contour, or on the left side of the Bar, is filled with the display color.

Syntax: **SET NSM.DISPLAY.FILL** *TRUE*| *FALSE*

The NSM.DISPLAY.FILL command determines how nasalance data are displayed during and after capture using NSM CAPTURE, or during and after audio playback using NSM SPEAK, when in Contour or Bar display mode (see NSM.DISPLAY.MODE).

Optionally select a filled display by setting NSM.DISPLAY.FILL to TRUE, or select a line display by setting it to FALSE.

When in Contour display mode, with a line display selected, nasalance is plotted as a single line contour across the window. When a filled display is selected, the area below the nasalance contour is filled with a solid color.

When in Bar display mode, with a line display selected, a single vertical line stretches across the window at the current nasalance percentage. When a filled display is selected, nasalance is represented by a filled bar graph, with the area to the left of the bar filled with a solid color.

If the setting is not specified on the command line, the Nasometer II Setup box is displayed. On the Display tab, enable the Fill Display checkbox if you want a filled contour or bar display, or clear the checkbox if you want a line display. After changing the setting, you may click APPLY in the Nasometer II Setup box to apply the new setting to the active NSM data window. Note that you cannot change the setting for an existing NSM window from the command.

NSM.DISPLAY.INVERT

Specifies whether to invert the nasalance display when in Contour or Bar display mode.

Syntax: **SET NSM.DISPLAY.INVERT** *TRUE|FALSE*

NSM.DISPLAY.INVERT may be set to TRUE to invert the contour when in Contour mode, or to change the orientation of the bar graph when in Bar mode (see NSM.DISPLAY.MODE). An inverted display has the effect of emphasizing the 'oralance' ratio, as opposed to the nasalance ratio. The normal nasalance representation is displayed when NSM.DISPLAY.INVERT is set to FALSE.

In Contour mode, time in seconds is displayed along the x-axis of the window, and the nasalance ratio in percentage is displayed on the y-axis. Normally, minimum nasalance (e.g., 0%) is at the bottom of the display, and maximum nasalance (e.g., 100%) at the top. When the contour display is inverted, the minimum percentage of nasalance is displayed in the upper part of the window, and the maximum percentage is displayed in the bottom part of the window.

In Bar mode, nasalance energy is displayed on the x-axis, and there is no representation on the y-axis. Normally, minimum nasalance is displayed on the left and maximum nasalance is displayed on the right (e.g., from 0% to 100%). When the bar display is inverted, the display is reversed, with maximum nasalance displayed on the left and minimum nasalance displayed on the right (e.g., from 100% to 0%).

The values for minimum and maximum nasalance display range are determined by the settings for NSM.DISPLAY.RANGE.

If the setting is not specified on the command line, the Nasometer II Setup box is displayed. On the Display tab, enable the Invert Display checkbox if you want an inverted contour or bar display, or clear the checkbox if you want a normal display. After changing the setting, you may click APPLY in the Nasometer II Setup box to apply the new setting to the active NSM data window. Note that you cannot change the setting for an existing NSM window from the command.

NSM.DISPLAY.MODE

Sets the nasalance display mode to Contour or Bar, or turns off the nasalance display.

Syntax: **SET NSM.DISPLAY.MODE** *CONTOUR* | *BAR* | *EMPTY*

CONTOUR is a real-time display measuring nasality on a time line
BAR is a real-time display of nasalance as a bar graph
EMPTY collects data in real time, but does not display the data

If NSM.DISPLAY.MODE is set to CONTOUR, a contour representing nasalance over a timeline is displayed in real time during data capture using NSM CAPTURE, and during audio playback using NSM SPEAK. After data capture, the last *n* seconds of the data are displayed, where *n* is determined by the setting for NSM.DISPLAY.DURATION.

If NSM.DISPLAY.MODE is set to BAR, a bar representing nasalance energy for the current frame of data is displayed on the x-axis during data capture or audio playback. After data capture, the nasalance ratio of the last frame of data is displayed in the bar display.

If NSM.DISPLAY.MODE is set to EMPTY, the nasalance display is turned off. This setting is used to avoid distracting the client with the display during data capture or audio playback.

Note that the information necessary for the calculation of each mode is gathered simultaneously when data are captured, when an existing audio file is analyzed using NSM ANALYSE, or when results are loaded from a file using either NSM LOAD.NAS or NSM LOAD.RESULTS. Thus, it is possible to switch between display modes once results have been obtained.

If the setting is not specified on the command line, the Nasometer II Setup box is displayed. On the Display tab, click the Contour, Bar, or Empty radio button in the Display Mode group to select the desired display mode. After changing the setting, you may click APPLY in the Nasometer II Setup box to apply the new setting to the active NSM data window. Note that you cannot change the setting for an existing NSM window from the command.

The window title bar always reports the current display mode setting, either Contour, Bar or Blank.

NSM.DISPLAY.RANGE

Specifies the upper and lower limit of the nasalance ratio display.

Syntax: **SET NSM.DISPLAY.RANGE** *min max*

min is an integer value ranging from 0 to a value that is one less than the value of *max*

max is an integer value ranging from a value that is one greater than the value of *min* to 100

NSM.DISPLAY.RANGE sets the nasalance ratio display range, in percent. The maximum display range is from 0% to 100%; the minimum display range is a separation of 1% between the lower limit and upper limit values.

If the display range is not specified on the command line, the Nasometer II Setup box is displayed. On the Display tab, enter new values in the Lower Limit and Upper Limit edit boxes, or use the spinner controls to increase or decrease the displayed values. After changing the settings, you may click APPLY in the Nasometer II Setup box to apply the new settings to the active NSM data window. Note that you cannot change the setting for an existing NSM window from the command.

When the program is set to Contour display mode (see NSM.DISPLAY.MODE), the nasalance ratio is displayed on the y-axis; when in Bar display mode, the nasalance ratio is displayed on the x-axis.

NSM.DISPLAY.TYPE

Specifies how the nasalance contour will be displayed during real-time capture and speak operations, when in Contour display mode.

Syntax: **SET NSM.DISPLAY.TYPE** *SWEEPING* | *SCROLLING*

SWEEPING - real-time contour display begins on the left of the window, and continues from left to right, overwriting data at the beginning when the right-most point is reached

SCROLLING - real-time contour display begins at the right of the window, and the contour scrolls to the left

When NSM.DISPLAY.MODE is set to CONTOUR, a real-time nasalance contour is displayed in the window during data capture (using NSM CAPTURE) and during audio playback (using NSM SPEAK). The NSM.DISPLAY.TYPE command controls how this contour is displayed.

If NSM.DISPLAY.TYPE is set to SWEEPING, the real-time display of the nasalance contour is fixed to the confines of the window duration. Starting on the left, the plot is displayed across the window. When the plot has reached the right hand side of the window, capture/display or speak/display continues with the plot overwriting the previous data, by returning to the left of the window and redrawing.

If NSM.DISPLAY.TYPE is set to SCROLLING, data are plotted starting on the right side, with the plot scrolling to the left, so that the most recent data results are always displayed at the rightmost point of the window.

If no setting is specified, the Nasometer II Setup box is displayed. On the Display tab, click the Sweeping or Scrolling radio button in the Contour Display Type group to select the desired display contour display type. After changing the setting, you may click APPLY in the Nasometer II Setup box to apply the new setting to the active NSM data window. Note that you cannot change the setting for an existing NSM window from the command.

NSM.FRAME.LENGTH

Specifies the length of a frame of data, in milliseconds.

Syntax: **SET NSM.FRAME.LENGTH** *len*

len is an integer in the range 8 to 100, representing the size of a frame of data, in milliseconds (msec)

NSM.FRAME.LENGTH sets the frame length value. This value dictates the frame length and frame advance for calculating the ratio of energy between the two input signals from the oral and nasal microphones.

This command is not available to the user to change from the Nasometer II Setup box.

NSM INIT

Command to initialize the active window for Nasometer II functions, without placing any data in the window.

Syntax: **NSM INIT**

Use NSM INIT to set up the active window to process Nasometer II data, according to the current settings for the NSM display parameters. Once initialized, the window is ready to display Nasometer II data resulting from the execution of the NSM CAPTURE, NSM ANALYSE, NSM LOAD.RESULTS or NSM LOAD.NAS commands. The color of the display is determined by the setting for WINDOW.PEN.

Note that once a window has been initialized for NSM functions, you cannot change the display or analysis parameters for that NSM window from the command line. You must either PURGE the window, then execute the NSM INIT command again to initialize the window with the latest settings, or you must use the SET NSM command to display the Nasometer II Setup dialog box, make the desired changes, then click APPLY to apply the current NSM settings to the active window.

If the active window is already initialized to process Nasometer II data when the NSM INIT command is executed, the command is ignored.

NSM LOAD.NAS

Command to clear the active window, then open a Nasalance result file from the NM2 DOS program, for display in the active window.

Syntax: **NSM LOAD.NAS** *filename*

The NSM LOAD.NAS command allows you to load nasalance results data from a NM2 DOS file into the active window. If the active window contains nasalance data when the NSM LOAD.NAS command is executed, a message box is displayed warning that all existing data will be removed and asking for confirmation to continue. Click YES to continue with the file load operation, or click NO to cancel the operation.

Any existing data in the active window are removed when data are loaded from a file. Note that loaded nasalance data are not supported by signal data, and therefore audio output cannot be generated from the data using NSM SPEAK.

Filename may include the full directory path, and must include the file extension, which is normally NAS.

If *filename* is not specified, a standard Open box is displayed, showing the current default directory name and the file extension for NM2 files. If necessary, scroll to a different directory containing the file to load. A list of the files in the current directory with the selected file extension is displayed. Choose a file from the displayed list, then click OPEN to load the nasalance data from the file, displaying the NSM plot in the active window.

The data display is not limited to the current setting for NSM.DISPLAY.DURATION, but the entire length of data are displayed when results are loaded from a file.

You may use the RESULT and STATS commands to display numerical results and result statistics for the loaded data. The frame length/advance value is assumed to be 10 milliseconds.

NSM LOAD.RESULTS

Command to clear the active window, then open a Nasalance result file for display in the active window.

Syntax: **NSM LOAD.RESULTS** *filename*

The NSM LOAD.RESULTS command allows you to load nasalance results data from a file into the active window. If the active window contains nasalance data when the NSM LOAD.RESULTS command is executed, a message box is displayed warning that all existing data will be removed and asking for confirmation to continue. Click YES to continue with the file load operation, or click NO to cancel the operation.

Any existing data in the active window are removed when data are loaded from a file. Note that loaded nasalance data are not supported by signal data, and therefore audio output cannot be generated from the data using NSM SPEAK.

Filename may include the full directory path, and must include the file extension, which is normally OUT.

If *filename* is not specified, a standard Open box is displayed, showing the current default directory name and the file extension for NSM files. If necessary, scroll to a different directory containing the file to load. A list of the files in the current directory with the selected file extension is displayed. Choose a file from the displayed list, then click OPEN to load the nasalance data from the file, displaying the NSM plot in the active window.

The data display is not limited to the current setting for NSM.DISPLAY.DURATION, but the entire length of data are displayed when results are loaded from a file.

You may use the RESULT and STATS commands to display numerical results and result statistics for the loaded data. The frame length/advance value is read from the file header of a loaded text file.

NSM LOAD.STIMULUS

Command to clear the Stimulus Display Window, then open a stimulus text or bitmap file and display the text or pictures in the Stimulus Display Window.

Syntax: **NSM LOAD.STIMULUS** *filename*

The NSM LOAD.STIMULUS command allows you to load pictures or text from a file into the Stimulus Display Window. Any existing data in the window are removed when data are loaded from a file.

Filename may include the full directory path, and must include the correct file extension, namely BMP for picture stimulus files and STM for text stimulus files.

If *filename* is not specified, a standard Open box is displayed. Select the type of stimulus file to load (picture or text) from the Files of Type box. A list of the files in the current directory with the standard file extension for the selected file type is displayed. If necessary, scroll to a different directory containing the file to load. Choose a file from the displayed list, then click OPEN to load the stimulus file into the Stimulus Display Window.

If the Stimulus Display Window is not open when the command is executed, the program will remember the name of the requested stimulus file, and this file will be displayed when the Stimulus Display Window is next opened using the ATTACH command.

NSM.MONO.CHANNEL

Specifies which audio channel to monitor when audio playback mode is set to Mono.

Syntax: **SET NSM.MONO.CHANNEL** *NASAL | ORAL*

When data are captured using NSM CAPTURE, the oral and nasal signals are stored in separate channels in the audio data buffer. During audio playback of the data using NSM SPEAK, you may hear stereo output of both signals or mono output of one of the signals from both speakers, depending on the setting for NSM.AUDIO.MODE.

NSM.MONO.CHANNEL allows you to specify which of the two (2) available audio channels are output when NSM.AUDIO.MODE is set to MONO. Options are to monitor either the ORAL or the NASAL channel.

If no setting is specified, the Nasometer II Setup box is displayed. On the Playback tab, click the Nasal or Oral radio button in the Mono Channel to Monitor group to select the desired audio channel. After changing the setting, you may click APPLY in the Nasometer II Setup box to apply the new setting to the active NSM data window. Note that you cannot change the setting for an existing NSM window from the command.

NSM.REFERENCE.CURSOR

Specifies the location for placement of a reference cursor in the window, as a percentage of the displayed scale.

Syntax: **SET NSM.REFERENCE.CURSOR** *percent*

percent is an integer in the range 0 to 100, representing the location on the nasalance scale to display the reference cursor

NSM.REFERENCE.CURSOR controls the location on the nasalance scale for placement of the reference cursor in the nasalance window.

If *percent* is set to 0, the reference cursor is displayed across the window at the minimum nasalance ratio location when NSM.DISPLAY.MODE is set to either CONTOUR or BAR. Normally this will be along the bottom of the display when in Contour mode, or on the left-hand side of the display when in Bar mode. However, if NSM.DISPLAY.INVERT is set to TRUE, the reference cursor will be displayed along the top of the window in Contour mode, or on the right hand side in Bar mode.

The nasalance ratio display range is set by NSM.DISPLAY.RANGE. If percent is set lower than the minimum display range setting, the reference cursor is displayed on the axis of the minimum nasalance ratio. If percent is set higher than the maximum display range setting, the reference cursor is displayed on the axis of the maximum nasalance ratio.

If *percent* is not specified, the Nasometer II Setup box is displayed. On the Reference tab, enter a new percent by typing a percent value into the Reference Cursor edit box or by using the slider control. After changing the setting, you may click APPLY in the Nasometer II Setup box to display the reference cursor at the new location in the active Nasometer II data window. Note that you cannot change the setting for an existing NSM window from the command.

NSM SAVE.SIGNAL

Command to save the two-channel (oral and nasal) Nasometer II signal to a file, with the Nasalance contour optionally saved to Channel 3. Note that the unfiltered audio signals are saved.

Syntax: **NSM SAVE.SIGNAL** *filename*

Use NSM SAVE.SIGNAL to save the 2-channel Nasometer II signal data to a waveform data file. If the source signal is not available for the Nasometer II results in the active window, an error message is displayed. This will be the case if the Nasalance results were loaded from a Nasometer II results file using NSM LOAD.RESULTS or NSM LOAD.NAS. Signal data are available with Nasalance results obtained using the NSM CAPTURE or NSM ANALYSE commands.

If *filename* is not specified on the command line, a standard Save As box is displayed. Scroll to the desired location for storage of the waveform data file, then enter a file name in the File Name box. By default, files are saved in CSL signal file format. If not included with the filename, an NSP file extension is appended to the entered name when the file is saved.

You may also specify that the file be saved in wave audio file format by selecting Wave Audio Files from the Save As Type drop-down box. In this case, a WAV file extension is appended to the filename when the file is saved.

Complete the file saving operation by clicking SAVE. The nasal signal is stored in channel 1 and the oral signal is stored in channel 2 of the saved stereo audio file. If saving the file in CSL Signal File format, a Saving Signal Data box is displayed, giving the option of saving the Nasometer II contour data to Channel 3 in the NSP file. As the Wave Audio File format supports only two channels of data, this option is not provided when saving in WAV format.

Optionally, you may specify the *filename* on the command line. Note that in this case, the file will be saved in CSL Signal File format. An NSP file extension should be included with the filename, to identify the file type. The file is saved to the Nasometer II data directory unless you include the full directory path with the filename.

NSM SHOW

Command to re-display the data in the window using the current window display settings.

Syntax: **NSM SHOW**

When nasalance data are displayed in either Contour or Bar mode, the color for the display is determined by the setting for WINDOW.PEN. When the pen color is changed, the currently displayed data are not normally affected; the change only goes into effect when new data are recorded or loaded into the window.

NSM SHOW updates the displayed nasalance data in the window to the current window display settings. This allows you to apply a change in pen color, for example, to the current display.

NSM.SINGLE.PASS

Specifies whether data capture will halt automatically when the capture buffer is full, or whether capture will continue until manually stopped.

Syntax: **SET NSM.SINGLE.PASS** *TRUE|FALSE*

When the NSM CAPTURE command is executed, a circular buffer is initialized, enabling continuous capture of the data. The maximum amount of data that can be captured and held in memory is determined by the setting for NSM.ANALYSIS.DURATION.

If NSM.SINGLE.PASS is set to FALSE, data capture continues indefinitely until the ENTER, ESC or SPACEBAR is pressed. Once the capture buffer is filled, data at the start are overwritten. The last *n* seconds of captured data are retained in memory, where *n* is set by NSM.ANALYSIS.DURATION.

If NSM.SINGLE.PASS is set to TRUE, the program will stop capturing automatically when the capture buffer is full. Note that in this case, you can still terminate data capture before the capture buffer is full by pressing ENTER, ESC or SPACEBAR. This enables the user to capture data without having to press a key to stop the capture process. This also ensures that the data at the beginning of the capture buffer is not overwritten when data appending is turned on using NSM.DATA.APPEND.

If the setting is not specified on the command line, the Nasometer II Setup box is displayed. On the Analysis tab, enable the Single Pass checkbox if you want single pass data capture, or clear the checkbox if you do want continuous data capture. After changing the setting, you may click APPLY in the Nasometer II Setup box to apply the new setting to the active NSM data window. Note that you cannot change the setting for an existing NSM window from the command.

NSM.SIGNAL.RATE

Sets the number of samples of samples per second that will be acquired during analog-to-digital conversion of a signal.

Syntax: **SET NSM.SIGNAL.RATE** *r*

r is an integer in the range 5000 to 44100, representing the sampling rate for data capture

NSM.SIGNAL.RATE enables selection of the analog-to-digital sampling rate for capturing Nasalance data. If a rate outside the allowed range is entered, an error message is displayed.

This command is not available to the user to change from the Nasometer II Setup box.

NSM.SILENCE.DIFFERENCE

Specifies the minimum dB SPL value for the lower silence threshold, set relative to the value of the upper silence threshold.

Syntax: **SET NSM.SILENCE.DIFFERENCE** *diff*

diff is a real number in the range 0.00 to 80.00, in dB SPL

The lower silence threshold is applied to both the oral and nasal signal channels. The value of the lower silence threshold is equal to *thresh – diff*, where *thresh* is set by NSM.UPPER_SILENCE.THRESHOLD. For example, if *thresh* is set to 50 dB SPL and *diff* is set to 17 dB SPL, the lower silence threshold value equals 50-17 = 33 dB SPL.

A nasalance frame is declared to be silent if the energy of both the oral and the nasal signal used to calculate the nasalance frame is less than the upper silence threshold value *thresh*. For example, if *thresh* is set to 50 dB SPL, the frame is declared to be silent if the energy of the oral signal is < 50 dB SPL and the energy of the nasal signal is < 50 dB SPL.

In addition, if the energy of either the oral or nasal frame is less than *thresh – diff*, the frame is declared to be silent. For example, if *thresh* is set to 50 dB SPL and *diff* is set to 17 dB SPL, the frame is declared to be silent if the energy of the oral signal is < 33 dB SPL (i.e., 50-17) or the energy of the nasal signal is < 33 dB SPL.

The following table lists the possible values for oral and nasal energy relative to *thresh* and *diff*, and lists the results of each combination:

Oral Energy	Nasal Energy	Result
>= thresh	>= thresh	not silent
>= thresh	< thresh but>= thresh – diff	not silent
< thresh but>= thresh – diff	>= thresh	not silent
< thresh	< thresh	silent
< thresh – diff	(any value)	silent
(any value)	< thresh – diff	silent

If a frame is declared to be silent, it is given the nasalance value of 0.00%. A typical setting for silence difference is 17 dB SPL.

Do not set the value of NSM.SILENCE.DIFFERENCE to be greater than the value of NSM.UPPER_SILENCE.THRESHOLD.

If *diff* is not specified, the Nasometer II Setup box is displayed. However, the silence difference cannot be set from the Nasometer II Setup box.

NSM SPEAK

Command to generate audio output of a *range* of the sampled data stored in the data buffer of the specified NSM window, while simultaneously re-displaying the data.

Syntax: **NSM SPEAK** *label range*

label is a window identifying letter

The NSM SPEAK command activates the digital-to-analog output of the specified *range* of data in the specified window. The filtered or unfiltered signal may be monitored, depending on the setting for NSM.AUDIO.OUTPUT. You may also specify stereo or mono output using NSM.AUDIO.MODE, with the mono channel (i.e., oral or nasal) selected by NSM.MONO.CHANNEL. If STEREO output is selected, the nasal signal is sent to channel 1 output (left) and the oral signal is sent to channel 2 output (right).

If NSM DISPLAY.MODE is set to CONTOUR, the *range* may be specified using any valid location symbol followed by another location symbol that has a value that is greater than or equal to the value of the first location. If NSM.DISPLAY.MODE is set to BAR or EMPTY, the *range* must be specified using time values in seconds, or by using the location symbols 0 and *. BAR mode also recognizes the location symbol =, which in this case represents the currently displayed frame of data. If any other symbols are used to define a *range* when in BAR or EMPTY display modes, the *range* is ignored and all of the data are spoken.

During audio output, the data are re-displayed in the window in real time when NSM.DISPLAY.MODE is set to either CONTOUR or BAR.

Audio output may be halted at any time by pressing ENTER, ESC or the SPACEBAR.

NSM.THICKNESS

Specifies the width, in pixels, to display the nasalance contour line or bar display line when the display is not filled.

Syntax: **SET NSM.THICKNESS** *n*

n is an integer in the range 1 to 20, representing the thickness of the unfilled contour or bar display, in pixels

The setting for NSM.DISPLAY.MODE determines whether the nasalance data are displayed as a contour over time or as a bar graph, or turns off the nasalance display entirely. When the display mode is set to either Contour or Bar, the area below the contour or the left of the bar may optionally be filled with the display color, depending on the setting for NSM.DISPLAY.FILL.

If the filled display option is turned off, NSM.THICKNESS specifies the width, in pixels, of the contour or bar.

If the setting is not specified on the command line, the Nasometer II Setup box is displayed. On the Display tab, enter a new value in the Line Thickness edit box, or use the spinner control to increase or decrease the displayed value. After changing the setting, you may click APPLY in the Nasometer II Setup box to apply the new setting to the active NSM data window. Note that you cannot change the setting for an existing NSM window from the command.

NSM.TIMER.COLOR

Specifies the color for the timer light.

Syntax: **SET NSM.TIMER.COLOR** *name*

name is the name of the pen colors in INI

A timer light may be switched on to assist the timing of a patient's speech repetition rate during data capture, with the length of number of timer "flashes" per second specified by NSM.TIMER.RATE. This timer light flashes on and off in the status bar of the nasalance window.

NSM.TIMER.COLOR is used to specify the color of this timer light. Any defined pen color (taken from the NAMES list under PEN in the INI file) can be used as the timer light color.

If the setting is not specified on the command line, the Nasometer II Setup box is displayed. On the Reference tab, enter the name of a different color in the Timer Color edit box (at the top of the Timer Color list box), or select a new color from the Timer Color list box. After changing the setting, you may click APPLY in the Nasometer II Setup box to apply the new setting to the active NSM data window. Note that you cannot change the setting for an existing NSM window from the command.

NSM.TIMER.RATE

Sets the length of the timer pulse cycle in the nasalance window status bar during data capture.

Syntax: **SET NSM.TIMER.RATE** *n*

n is an integer in the range 0 to 5, representing the number of timer flashes per second, where a setting of 0 has the effect of turning off the timer light

A timer light may be switched on to assist the timing of a patient's speech repetition rate during data capture. This timer light flashes on and off in the status bar of the nasalance window.

The NSM.TIMER.RATE command sets the pulse rate for the timer light, in number of flashes per second. If NSM.TIMER.RATE is set to 0, the timer light is turned off.

If the setting is not specified on the command line, the Nasometer II Setup box is displayed. On the Reference tab, enter a new value in the Timer Rate edit box, or use the spinner control to increase or decrease the displayed value. After changing the setting, you may click APPLY in the Nasometer II Setup box to apply the new setting to the active NSM data window. Note that you cannot change the setting for an existing NSM window from the command.

The color of the timing light is determined by the setting for NSM.TIMER.COLOR

NSM TRIM

Command to remove NSM data that is outside a specified *range* in the active window, redrawing the remaining Nasometer II contour with any leading or trailing data outside the *range* removed from memory. Conversely, NSM TRIM provides the option of deleting the data within the specified *range* from memory and redrawing the active window with the leading and trailing data "pasted" together.

Syntax: **NSM TRIM** *range X*

X optional switch to keep the area outside the specified *range*. The data within the specified *range* are removed from memory.

NSM TRIM is generally used after real-time capture and processing, to trim leading or trailing portions of the captured NSM data. The command erases the data that are outside the specified *range* from memory, so that they cannot be recovered. The remaining data in memory are then moved to free up memory for other operations, and the first remaining data point in the *range* is labeled with the location value of 0.

Note that the range parameters must be in the correct order, with the lowest time location stated first. The active window must contain NSM data prior to command execution, and NSM.DISPLAY.MODE must be set to CONTOUR, or an error message is displayed.

When the *X* option is used, the data within the specified range are cut from memory. The remaining data are spliced together and are redrawn in the active window with time coordinates adjusted to treat the newly combined sections of data as a continuous series. Trimming to remove data within a specified region will enable the user to remove events such as a cough when reading a prescribed passage.

NSM.UPPER_SILENCE.THRESHOLD

Specifies the minimum dB SPL value for the upper silence threshold.

Syntax: **SET NSM.UPPER_SILENCE.THRESHOLD** *thresh*

thresh is a real number in the range 0.00 to 80.00, in dB SPL

The upper silence threshold is applied to both the oral and nasal signal channels.

A nasalance frame is declared to be silent if the energy of both the oral and the nasal signal used to calculate the nasalance frame is less than the upper silence threshold value *thresh*. For example, if *thresh* is set to 50 dB SPL, the frame is declared to be silent if the energy of the oral signal is < 50 dB SPL and the energy of the nasal signal is < 50 dB SPL.

In addition, if the energy of either the oral or nasal frame is less than *thresh – diff* (where *diff* is set by NSM.SILENCE.DIFFERENCE), the frame is declared to be silent. For example, if *thresh* is set to 50 dB SPL and *diff* is set to 17 dB SPL, the frame is declared to be silent if the energy of the oral signal is < 33 dB SPL (i.e., 50-17) or the energy of the nasal signal is < 33 dB SPL.

The following table lists the possible values for oral and nasal energy relative to *thresh* and *diff*, and lists the results of each combination:

Oral Energy	Nasal Energy	Result
>= thresh	>= thresh	not silent
>= thresh	< thresh but>= thresh – diff	not silent
< thresh but>= thresh – diff	>= thresh	not silent
< thresh	< thresh	silent
< thresh – diff	(any value)	silent
(any value)	< thresh – diff	silent

If a frame is declared to be silent, it is given the nasalance value of 0.00%.

A typical setting for silence threshold is 50.0 dB SPL. In this case, if either the oral or the nasal channel has an energy value less than 50 dB SPL, the signal is too weak and the nasalance frame is declared to be silent.

Do not set the value of NSM.SILENCE.DIFFERENCE to be greater than the value of NSM.UPPER_SILENCE.THRESHOLD. If *thresh* is not specified, the Nasometer II Setup box is displayed. However, the silence threshold cannot be set from the Nasometer II Setup box.

PRNTSCRN

Command to dump the current graphics information in the work area to a printer.

Syntax: **PRNTSCRN**

When the PRNTSCRN command is executed, a Screen Print box is displayed. You may add a Header and/or Footer to the printout, using the format *left;center;right*. In other words, text entered to the left of the first semi-colon (;) is left justified, text entered after the first semi-colon is centered, and text entered after a second semi-colon is right justified. Note that it is not necessary to enter text for each area in the header/footer. Simply use semi-colons to position the text in the desired location. Any text can be entered, with %p representing page number, %d representing date and %t representing time. For example, if you type; Page %p in the Footer box, the printout will contain the word Page, followed by a page number, along the bottom. The information is centered as it is after the first semi-colon.

Click SETUP to access a Print Setup box, where you may specify the printer to use, the page orientation, the paper size and the paper source. Click FONT to specify the font to use when printing the Header/Footer information, the font style (i.e. regular, bold, italic), and the font size.

Once you have entered any desired Header and/or Footer and have made any changes to the Printer Setup and Font settings, click PRINT to generate a printout of the work area.

QUIT

Command to exit the program.

Syntax: **QUIT**

An information box is displayed, in which confirmation to exit the program is requested. Select YES to exit the program or select NO to return to program operations.

This command is the same as EXIT.

RESULT

Command to display the numerical analysis results associated with the NSM data in the specified window, and optionally print or save this data.

Syntax: **RESULT** *label*

label is a window identifying letter

The RESULT command causes numerical results obtained from the NSM plot in the specified window to be displayed in a Nasometer II Analysis Results box. If a window *label* is not specified, the command acts on the currently active window.

Numerical results are computed and displayed only for data within the current display range, defined by NSM.DISPLAY.RANGE. Time, Nasal Energy, Oral Energy, and Nasalance Ratio headings are displayed along the top of the box. You may scroll through the results using the mouse or cursor control keys.

Select SAVE AS to save the analysis results to a file. Select the correct drive and folder, then enter a filename in the File Name box. If not included with the filename, an OUT file extension is appended to the entered name when the file is saved. Select a column separator, which may be a space, tab, or comma. Choose TAB or COMMA to format the file for access by a spreadsheet program. Select SPACE to save the file so that the display is easily read when you send it to the printer or if you intend to edit it at a later date using any standard text editor. You must also specify the analysis information you wish to save to the file by enabling the appropriate check boxes. This may include statistics and numerical results. Finally, click SAVE to continue with the file save operation. Click CANCEL to close the Save As box without saving the file.

After you click SAVE, a Nasometer II Header Information box is displayed. You may enter Patient Identification information in the provided spaces, including Institution Name, Patient Name and Case Number. Fields for Date and Stimulus File are automatically filled in, but may be modified. Click OK to add this Patient Identification information at the top of the file being saved. Click SKIP to save the file without adding this header information. Click CANCEL to return to the Save As box.

From the Nasometer II Analysis Results box, select PRINT to display a Nasometer II Print Setup box. In the Margins section, you may enter page header and/or footer information. In the Contents section, select the analysis information you wish to print by enabling the appropriate check boxes. This may include the displayed numerical results and statistics. Click SETUP to access a standard Print Setup box, where you may specify which printer to use, paper size and orientation. Click FONT to select a particular font to use. Once you have defined the print settings, click PRINT in the Nasometer II Print Setup box to continue with the print operation. Click CANCEL to close the box without printing the file.

After you click PRINT, a Nasometer II Header Information box is displayed. Again, you may enter Patient Identification information in the provided spaces, then click OK to generate the printed report with this information added at the top of the page. Click SKIP to print the file without adding this header information. Click CANCEL to return to the Nasometer II Print Setup box.

From the Nasometer II Analysis Results box, select DONE to return to normal program operations.

SELECT

Command to select a range of data in the Nasometer II data window, when nasalance results are displayed using Contour display mode.

Syntax: **SELECT** *range*

The SELECT command allows you to select a range of data in the active window, known as the selection area. The start and end of the selected data is identified in two boxes on the window status bar that report the ss (selection start) location and the se (selection end) location.

Use SELECT to zoom in on an area of interest in the data. Once a range of data is selected, you may display or speak the data in the selection area, or perform a number of analysis and editing operations on the selected data.

Selection areas may be defined in windows containing nasalance results where the window is set for Contour display mode (see SET NSM.DISPLAY.MODE).

If a scroll bar is displayed in the window, the blue indicators above the scroll bar are updated to reflect the new locations of the selection start and selection end marks in the data

It is possible to remove the selection marks from the data in the active and linked windows using the UNSELECT command.

SET FROM

Command to specify an initialization file to read parameter settings from and save parameter settings to.

Syntax: **SET FROM** *INI*| *PREVIOUS* | *filename*

Use the SET FROM command to specify the configuration file to use when accessing and saving parameter settings. SET FROM INI tells the program to activate the user configuration file. SET FROM PREVIOUS tells the program to re-activate the previously active configuration file. This is a useful feature in macros, for example, where you may set the program to use a specified initialization file at the start of the routine, then reset to the previous settings at the end.

Use SET FROM *filename* to activate any other saved configuration file. Any file extension added to a *filename* must be included when you enter the *filename*. The *filename* may include a full directory path. If no path is specified, the program loads files from and saves files to the program directory. If you specify a non-existent *filename*, the program creates a new file.

If the SET FROM command is executed and no file is specified, a Load Configuration box is displayed on the screen. This is a standard Open dialog box, supplied by Windows. Check the drive and directory location, then select a file from the displayed list or enter a file name in the File Name box.

Whenever program settings are modified, the new parameter settings are saved in a temporary copy of the active configuration file until specifically written to the active file. This allows you to discard changes made during a session so that you start each session from the same configuration.

If configuration changes have been made when the SET FROM command is executed, you are asked if you wish to save the changes to the permanent copy of the active initialization file before switching to the new file. To avoid the display of this dialog box, you can use SET FROM.SAVE to automatically save changes to the permanent copy of the active file before activating a new configuration file, or you can use SET FROM.NOSAVE to automatically discard any changes stored in the temporary file when you activate a new configuration file.

As an example, suppose you wish to create a macro that captures data and then performs several analysis functions on the captured signal. You might use the command SET FROM MACRO1.INI to create a configuration file for the macro, in which you would set all required analysis parameters. After the configuration file is created, you create the macro. The first line of the macro might be the command SET FROM MACRO1.INI. You would then enter commands to perform all desired operations. The final command in the macro would be SET FROM.NOSAVE PREVIOUS to restore the parameter settings that were in use prior to macro execution, automatically discarding any changes made to the macro initialization file.

SET NSM

Calls a dialog box that allows selection of the NSM capture, processing and display parameters.

Syntax: **SET NSM**

Displays a dialog box in which you may set the Analysis, Display, Reference and Playback parameters for Nasometer II program operation.

SET PATH

Command to specify the default directory (folder) for a specified program operation by command. This may be used within a macro or some other environment where user input is not desired.

Syntax: **SET PATH.***name dir*

name identifies the operation whose path you wish to set

dir is the full path name of the folder

Several program operations retrieve files from or save files to a folder. This command allows you to set the default location for file storage and retrieval for each of these operations.

In the PATH section of the program initialization file, a number of default file locations are defined for program operations, including:

SIGNAL	The location of audio signal files.
MACRO	The location of macro files.
TEMPLATES	The location of user initialization files.
OUTPUT	The location of output files, generated when numerical results or result statistics are saved.
STIMULUS	The location of text or picture stimulus files.

Any of these paths, or any other path, may be defined using SET PATH, e.g., SET PATH.SIGNAL, SET PATH.MACRO, SET PATH.TEMPLATES, SET PATH.OUTPUT, SET PATH.STIMULUS.

SET RESET

Command to reset the program configuration.

Syntax: **SET RESET** *DEFAULT| SESSION*

To reset the program configuration to the factory default settings delivered with the program, use SET RESET DEFAULT. The permanent and temporary copies of the user configuration file are deleted, and the program settings are reset to the factory defaults. Note that this change in configuration is PERMANENT; user settings cannot be recovered using the SET FROM command.

Use SET RESET INI to delete the temporary copy of the active configuration file, and create a new temporary copy based on the settings in the permanent (last saved) copy of the active INI file. This command may be used to discard changes made in the session and reset any active configuration file to its permanent state.

If the SET RESET SESSION command is executed, the temporary copy of the user configuration file is deleted. The program is reset to the configuration last saved in the user configuration file.

In each case, a warning message is displayed before the program configuration is reset, and you are given the option of continuing or canceling the operation.

SET STIMULUS

Calls a dialog box that allows selection of the stimulus text font size.

Syntax: **SET STIMULUS**

Displays a dialog box in which you may set the font size used to display text in the stimulus display window.

SET TO

Copy the program settings made during the current session to a specified configuration file. These settings can later be accessed using the SET FROM command.

Syntax: **SET TO** *INI* | *filename*

Each time you start the program, a temporary "session" configuration file is created to store all changes made to the program parameter settings. At any time, you may save these changes to the active configuration file using the command SET TO INI. You may also save them to a different file using SET TO *filename*. *Filename* may include a directory path, and should include an .INI file extension. If *filename* already exists, you are asked if you wish to replace the existing file.

A SET TO SESSION command also exists, which allows you to overwrite the user configuration file with the settings in the temporary copy of the user configuration file. The user configuration file must be active when you execute this command, or an error is returned.

If you execute the SET TO command without specifying a filename, a Save Configuration box is displayed. This is a standard File Open/File Save dialog box, supplied by Windows. Check the drive and directory location, then enter a file name in the File Name box or select a file from the displayed list if you wish to replace an existing file.

Note that you may not overwrite the default configuration file from within the program.

SET WINDOW

Calls a dialog box, which allows selection of the WINDOW parameters. The only window option that applies to Nasometer II data window is the pen color.

Syntax: **SET WINDOW**

You can specify the pen color, whether normalization is applied, and whether a grid is placed over the data in the window. You may also specify whether to display a scroll bar below the horizontal axis of the window and, if so, whether to update the graphic display in the window during scrolling or after scrolling.

Note that normalization and grid line settings are ignored when a window is initialized for Nasometer II operations using NSM INIT.

Once you change a window display setting, you may redisplay the existing data with the new window settings if you wish to change the display properties of the existing data. This may be done from within the Window Options dialog box by clicking APPLY. Alternatively, you may use the SHOW command to redisplay the data using the new window display settings. Note that if the window contains multiple analysis data, only the topmost data will be redisplayed using the new window settings. The display of earlier analysis results is not affected.

SET WINDOW.DYNAMIC

If a scroll bar is displayed in the window, the window may be set to update the graphic display dynamically (during scrolling) or after scrolling.

Syntax: **SET WINDOW.DYNAMIC** *TRUE*| *FALSE*

A scroll bar may be displayed under the horizontal axis of a window using SET WINDOW.SCROLLBAR. This scroll bar represents the full range of data in the window. Whenever less than the full range of data is displayed in the window, the thumb in the scroll bar shows the relative location of the currently displayed data.

You may scroll back and forth through the data in the window while retaining the original display duration by clicking on the thumb in the scroll bar and dragging it left or right. If WINDOW.DYNAMIC is turned *TRUE,* the graphic display in the window is updated as you drag the thumb along the scroll bar. If WINDOW.DYNAMIC is turned *FALSE,* the graphic display in the window is updated when the mouse button is released.

If the set-up parameter value is not specified on the command line, a dialog box is displayed in which you may set the value.

WINDOW

Command to create and activate a new window, or to manipulate existing windows.

Syntax: WINDOW *label left top width height color n h v m s d*

WINDOW *name*

WINDOW RESET group_name | DEFAULT | WORKAREA

WINDOW SAVEALL *group_name*

WINDOW SAVEAS *name*

WINDOW CASCADE

WINDOW TILE HORIZONTAL | VERTICAL

WINDOW MINIMIZE *label*

WINDOW MAXIMIZE *label*

WINDOW RESTORE *label*

label is a window identifying letter

left is the left vertical window position

top is the top horizontal window position

width is the total width of the window

height is the total height of the window

color is the name of the initial drawing color

n preceded by + or - sets normalization on or off for the newly created window

h preceded by + or - sets horizontal lines on or off for the newly created window

v preceded by + or - sets vertical lines on or off for the newly created window

m preceded by + opens the window in a maximized state; preceded by - opens the window in a minimized state

s preceded by + or - turns scroll bar display on or off for the newly created window

d preceded by + sets the window to update the graphic display during scrolling using the scroll bar; preceded by – sets the window to update the graphic display after scrolling using the scroll bar

name is the name of a window template that has been previously saved using the **WINDOW SAVEAS** command.

The first four parameters *left, top, width* and *height* are optional screen coordinate parameters, which are integer values. They define the size of the window on a percentage scale of the available space, rather that identifying pixel locations. If these parameters are specified, they must all be entered. A 1-10000 scale is used, therefore the minimum and maximum values for each parameter are 0 and 10,000 (i.e. min and max values are not dependent on the resolution of your monitor). The program divides the monitor into 10000 horizontal rows and 10000 vertical columns, and these values are stated relative to this. For example, if *top* is set to 2000, then the top of the window is positioned 2000/10000*100% =20% of the way down the monitor.

The last seven parameters, *color, n, h, v, m, s,* and *d,* are window attribute parameters. *Color* is the name of the pen color to use in the window until a new pen color is selected. The *color* may be specified as BLACK, RED, GREEN, BLUE, PURPLE or YELLOW, or any other color defined in the initialization file. The parameters *n, h, v, m, s,* and *d* are specified as +n or -n, +h or -h, +v or -v, +m or -m, +s or -s, and +d or -d respectively. Any window attribute value may be entered on the command line after the four screen coordinate values have been entered.

If the window attribute parameters *color, n, h, v, m, s,* or *d* are not specified, their settings are determined by the previously active window. If no previous window exists, their settings are taken from the program initialization file. If the attribute *m* is not specified, the window is opened in a normal state (i.e., neither minimized nor maximized).

Specifying the coordinate parameters will create and activate a new window. If the coordinates are entered incorrectly, an error message is returned. If no parameters are specified, a window template is drawn on the screen, which may be adjusted using the mouse. Any window can be adjusted in size and in placement on the screen with the mouse.

The new window is designated the active window and placed at the top of the window list. Unless a different *label* is specified on the command line, the new window is assigned the next available *label,* which is one of twenty-six letters, A through Z, used to identify the window. The window label appears in its top left corner. Depending upon the number of windows that have been created and deleted previously, the next *label* given to a window will not necessarily be consecutive with a previously created window. If the window list already contains twenty-six windows, no action will be taken when the WINDOW command is executed.

Use WINDOW MAXIMIZE to maximize a window to fill the work area. Use WINDOW MINIMIZE to shrink a window to an icon, then use WINDOW RESTORE to restore a minimized window to its original size and placement when you want to work with the data again.

After creating a window, you may assign a template name to the window coordinates and screen attribute parameters using the WINDOW SAVEAS command. You may then create windows based on this template using the WINDOW *name* option. Pre-existing window template names are WAVEFORM, SPECTROGRAM, CONTOUR and RESPONSE.

Once you have created a group of windows in the work area, you may assign this group a unique name using WINDOW SAVEALL *group_name*. To reset the work area to display this defined group of windows, use WINDOW RESET *group_name*.

You may also rearrange the display of the windows in the work area using WINDOW CASCADE or WINDOW TILE. These commands resize and reposition the open windows (excluding minimized windows) in the work area so that all or a part of each window is visible.

When you exit the program, the configurations of all windows may optionally be saved in a user initialization file in the format of executable commands. The saved commands include the settings of the attributes for each window.

No data are associated with the new window until waveform data have been captured, loaded or copied to it, or analysis or transient data have been placed in it.

SET WINDOW.PEN

Selects one of the available colors of the pen that is to be used to draw a graphics line in the active window.

Syntax: **SET WINDOW.PEN** *name* | NEXT

The pen color is selected by specifying the color *name*, which may be BLACK, RED, GREEN, BLUE, PURPLE, YELLOW, ORANGE or CYAN, or any other color defined in your initialization file. If *name* is not specified, the Window Options dialog box is displayed. Click on the name of the desired pen color in the dialog box. You may also use the command SET WINDOW.PEN NEXT, which selects the next pen color in the list.

Note that a color setting is made for the active window. It does not affect the previous setting made for any inactive window. You may use the SHOW command to re-display the nasalance data using the new pen color when the window is set to Contour display mode (see SET NSM.DISPLAY.MODE). If the *name* not recognized, the previous color setting is retained.

SET WINDOW.SCROLLBAR

Displays a scroll bar under the horizontal axis of the active window.

Syntax: **SET WINDOW.SCROLLBAR** *ON*| *OFF*

Use SET WINDOW.SCROLLBAR *ON* to display a scroll bar under the horizontal axis of the active window. This scroll bar represents the full range of data in the window. Whenever less than the full range of data is displayed in the window, the thumb in the scroll bar shows the relative location of the currently displayed data. Using the thumb in the scroll bar, you may scroll back and forth through the data while retaining the original display duration. Click on the thumb and drag it left or right.

Use SET WINDOW.SCROLLBAR *OFF* to turn off the display of the scroll bar in the active window.

If a scroll bar is displayed in the window, the window may be set to update the graphic display during scrolling or after scrolling using SET WINDOW.DYNAMIC.

If the set-up parameter value is not specified on the command line, a dialog box is displayed in which you may set the value.

SHOW

Command to display a specified range of nasalance data in the Nasometer II data window. Note that this command is only valid when the window is set to Contour display mode.

Syntax: **SHOW** *range*

SHOW displays waveform data and analysis data by accessing the data values in memory and displaying the requested *range*. If more than one analysis has been performed and the analysis results have been overlaid in the active window, issuing a SHOW command will re-display all data in the window.

Note that the *range* parameters must be in the correct order. If showing time domain information, the lowest time *location* must be stated first. If showing frequency domain information, the lowest frequency *location* must be stated first. If the end of the *range* specified is greater than the maximum time or frequency value in the data, only that part of the data for which there is information is displayed. The remainder of the area in the window stays blank.

The SHOW command is only valid if the Nasometer II data window contains nasalance results that are displayed in Contour display mode (see SET NSM.DISPLAY.MODE).

If a scroll bar is displayed in the window, the thumb of the scroll bar is updated to reflect the relative location of the currently displayed data.

STATS

Command to compute and display a series of statistical analyzes that are derived from the selected region of the NSM analysis results in the active window, and to provide facilities for saving or printing these statistics.

Syntax: **STATS**

By default, all of the data obtained using NSM CAPTURE, NSM ANALYZE, NSM LOAD.RESULTS or NSM LOAD.NAS are initially selected. When in Contour display mode, you may optionally select a subset of the data using the SELECT command.

The STATS command causes statistics derived from the NSM analysis results in the selection area of the active window to be computed and displayed in a Nasometer II Statistics box.

To save the statistics to a file, click SAVE AS. Select the correct drive and folder, then enter a file name in the File Name box. If not included with the filename, an OUT file extension is appended to the entered name when the file is saved. Choose a column separator, which may be a space, tab, or comma. Use TAB or COMMA to format the file for access by a spreadsheet program. Select SPACE to save the file so that the display is easily read when you send it to the printer or if you intend to edit it at a later date using any standard text editor. Specify the analysis information you wish to save to the file by enabling the appropriate check boxes. This may include the displayed statistics and the numerical results. Finally, click SAVE to continue with the file save operation. Click CANCEL to close the Save As box without saving the file.

After you click SAVE, a Nasometer II Header Information box is displayed. You may enter Patient Identification information in the provided spaces, including Institution Name, Patient Name and Case Number. Fields for Date and Stimulus File are automatically filled in, but may be modified. Click OK to add this Patient Identification information at the top of the file being saved. Click SKIP to save the file without adding this header information. Click CANCEL to return to the Save As box.

Select PRINT, causing a Nasometer II Print Setup box to be displayed. In the Margins section, you may enter page header and/or footer information. In the Contents section, select the analysis information you wish to print by enabling the appropriate check boxes. This may include the both displayed statistics and the numerical results. Click SETUP to access a standard Print Setup box, where you may specify which printer to use, paper size and orientation. Click FONT to select a particular font to use. Once you have defined the print settings, click PRINT in the dialog box to continue with the print operation. Click CANCEL to close the box without printing the file.

After you click PRINT, a Nasometer II Header Information box is displayed. Again, you may enter Patient Identification information in the provided spaces, then click OK to generate the printed report with this information added at the top of the page. Click SKIP to print the file without adding this header information. Click CANCEL to return to the Nasometer II Print Setup box.

Select OK to return to normal program operations after viewing, and optionally saving and/or printing, the statistics.

SPRITE

Command to cause a "Sprite" graphic image to move in a pattern across the screen.

Syntax: **SPRITE** *tag*

tag is a single alphanumeric character that has been assigned to a graphic file (1-6)

Six sprite graphics images are supplied. The SPRITE command causes the image identified by *tag* to travel across the screen, going from left to right in one of six randomly determined patterns of movement. If *tag* is not specified or an invalid tag number is selected, the SPRITE command randomly selects the sprite to display from the list of available sprites.

Tag numbers correspond to graphic images as follows:

1 - aliens in flying saucer

2 - monkey with balloons

3 - hummingbird

4 - cat with balloons

5 - helicopter

6 - animals in hot air balloon

STIMULUS.FONT

Specifies the font size used to display text in the stimulus display window.

Syntax: **SET STIMULUS.FONT** *size*

size is an integer value in the range 8 to 72, inclusive

Use STIMULUS.FONT to specify the font size to display text in the stimulus display window.

If size is not specified, the Stimulus Text Font Size dialog box is displayed. Enter a new value in the Font Size edit box, between 8 and 72, inclusive. After changing the setting, you may click APPLY in the Stimulus Text Font Size box to apply the new setting to the attached stimulus display window. Note that you cannot change the setting for an existing window from the command.

TITLE

Allows you to enter a unique title for the data in the Nasometer II data window.

Syntax: **TITLE** *text*

text may be any string of characters used to identify the window contents.

Initially, the Nasometer II data window title reports the current display mode setting, for example, Nasometer Contour Display Mode. The TITLE command is useful in allowing you to easily identify the contents of a window by changing the window title.

If no text is entered after the TITLE command, by default the type of data that the window is initialized for is reported (i.e., NSM). Alternatively, TITLE *text* is used to change the window title to the specified text. If the display mode is changed through the Nasometer II Setup box, and this change is applied to the window, the window title will once again report the current display mode setting.

See SET NSM.DISPLAY.MODE for more information about Nasometer II window display modes.

UNSELECT

Remove selection marks from the active window.

Syntax: **UNSELECT**

A number of program operations can be performed using the selection area of the Nasometer II data window. If the Nasometer II data window contains nasalance results that are displayed in Contour display mode, two blue vertical bars are placed in a window to graphically show the locations of the start and end of the selection area.

When nasalance data are first placed in a window, the selection area is defined to be all the data in the window. You may remove the selection marks from the active windows.

The ss and se boxes on the window status bar normally report the start and end of the selected region of data. When selection marks are removed from a window, these boxes are blank. If a scroll bar is displayed in the window, the blue indicators above the scroll bar are removed.

Program operations that act on the selection area cannot be performed if selection marks have been removed. At any time, you may re-insert the selection marks using the SELECT command.

VERSION

Calls a dialog box, which displays information about the current version of the program.

Syntax: **VERSION**

When the VERSION command is executed, an About box is displayed in the work area. After reviewing the displayed information, click OK or press ENTER to clear the box from the screen.

WINDOW CASCADE

Command to rearrange the windows in the work area to overlap, with the title bar for each window visible.

Syntax: **WINDOW CASCADE**

When you open several windows in the work area, they begin to overlap in such a way that some of the windows are hidden beneath others. The WINDOW CASCADE command resizes and layers the open windows within the work area so that the title bar of each window is visible. Note that windows that are minimized when the WINDOW CASCADE command is executed are left minimized.

WINDOW MAXIMIZE

Command to maximize a specified window to fill the work area.

Syntax: **WINDOW MAXIMIZE** *label*

To better display the data in a specified window, use WINDOW MAXIMIZE *label* to maximize the window to fill the program work area. If *label* is not specified, the active window is maximized.

WINDOW MINIMIZE

Command to minimize a specified window, shrinking it to an icon at the bottom of the work area.

Syntax: **WINDOW MINIMIZE** *label*

When you have finished working with data in a specified window, but want it available for later use, use WINDOW MINIMIZE *label* to shrink the window to an icon at the bottom of the work area. The data are still held in memory but the window is not taking up space in the work area. If *label* is not specified, the active window is maximized.

The icon includes a title that identifies both the window label and contents. If the icon represents a window containing multiple analysis plots, the topmost plot is identified.

WINDOW RESET

After saving the settings for a group of windows using WINDOW SAVEALL, you may reset the work area to display these windows.

Syntax: **WINDOW RESET** *group_name* | *DEFAULT*| *WORKAREA*

group_name is a text string that identifies a particular group of windows in the work area.

After creating a series of windows having specific sizes, placements in the work area and window attributes, you may assign this work area setup a unique *group_name* using the WINDOW SAVEALL command. Later you may define the work area to redisplay this group of windows using WINDOW RESET *group_name*. If *group_name* is not entered on the command line, the work area is redrawn with the window setup that existed at program start-up.

Use WINDOW RESET DEFAULT to redraw the work area with the default window setup. Use WINDOW RESET WORKAREA to load the last window setup that was saved using the WINDOW SAVEALL WORKAREA command.

WINDOW RESTORE

Command to restore a minimized window to its original size and placement in the work area.

Syntax: **WINDOW RESTORE** *label*

Use WINDOW RESTORE *label* to restore a specified minimized window to its original size and placement when you want to work with the data again. If *label* is not specified, the active window is restored if it is minimized, otherwise no action is taken.

WINDOW SAVEALL

After creating a group of windows with repeated use of the WINDOW command, you may assign a *group_name* to this work area setup, which will be stored in the open initialization file.

Syntax: **WINDOW SAVEALL** *group_name*

group_name is a text string that identifies a particular group of windows in the work area.

After creating a group of windows having specific sizes, placements in the work area and window attributes, you may assign this work area setup a unique *group_name*. Later you may reset the work area with these windows by typing WINDOW RESET *group_name* on the command line.

WINDOW SAVEAS

After creating a new window using the WINDOW command, you may assign a *name* to the window settings, which will be stored in the open initialization file.

Syntax: **WINDOW SAVEAS** *name*

name is a text string that identifies a particular window setup

After creating a window, you may size it, move it and change any of the window attributes, such as pen color. You then have the option to assign this window template a unique *name*. Later you may create new windows based on this template by typing WINDOW *name* on the command line.

WINDOW TILE

Command to rearrange the windows in the work area in smaller sizes to fit in the work area.

Syntax: **WINDOW TILE** *HORIZONTAL | VERTICAL*

When you open several windows in the work area, they begin to overlap in such a way that some of the windows are hidden beneath others. The WINDOW TILE command divides the available space in the work area into smaller windows of similar size for each open window. Note that windows that are minimized when the WINDOW TILE command is executed are left minimized.

You may specify whether to arrange the windows horizontally or vertically in the work area. If a layout is not specified, the windows are tiled horizontally by default.

Appendix A - Installation and Setup

Introduction

The Nasometer II installation consists of four general steps as follows:

1. Selecting a host computer and unpacking the system
2. Installing the Santa Cruz sound card
3. Installing the Santa Cruz software drivers
4. Installing the Nasometer II software

Each of these four steps is described in separate sections in this appendix.

A separate appendix (i.e., **Appendix C – Adjustment to Nasometer External Module**) describes an adjustment that is necessary in Nasometer II systems shipped before March 2003.

Nasometer II systems, which were shipped before March 2003, need a change in the external module (i.e., two internal switches are flipped). This change was made to enhance repeatability and obtain the greatest speech dynamic range possible at one preamp setting (i.e., the second from bottom notch setting on the hardware preamp). The internal switch in the Nasometer II hardware enables an additional analog filter for the input speech channels. This change takes about five minutes. Enabling this filter will cause the speech playback to have lower fidelity, but the nasometric scores have been found to be more stable using the filtered input signal. To compare your data to the normative data published in this manual, you will need to make this hardware switch (in addition to having software 2.5 or higher installed).

Selecting a Host Computer and Unpacking the System

The Nasometer II includes a number of components. The Nasometer II requires a host computer for operation. If it was not delivered with a computer from Kay, you must first select an appropriate computer for Nasometer II installation. Nasometer II requires a computer powerful enough to support audio data and the graphic requirements of the applications software. It operates with a host PC computer with the following requirements:

1. Pentium ≥ 233MHz
2. Windows 98 or higher operating system compatible with sound card or sound module
3. Graphics card with 4 MB of video RAM
4. 64 MB of RAM (minimum) for program operation
5. CD-ROM drive
6. Mouse

NOTE: If your system does not meet these requirements, do not install Nasometer II. First obtain a system with sufficient resources to support this program.

System Components for Nasometer II, Model 6400

Unpack and inspect the Nasometer II. The following parts should be included:

1. Nasometer II external module
2. Nasometer II power supply
3. Headset
4. Y-Cable to connect Nasometer II to Santa Cruz sound card (i.e., dual male RCA to stereo miniphone)
5. Stereo 1/8" to 1/4" phone plug adapter. (This may be attached to headset.)
6. Santa Cruz sound card
7. Turtle Beach/Santa Cruz CD-ROM software
8. Kay Nasometer II CD-ROM software
9. HASP key. This is a small security device that is connected to the parallel port.
10. Manual

Installing the Santa Cruz Sound Card

Introduction

In the interest of optimal system performance, Kay has provided each customer with a new sound card with specific and known characteristics to ensure consistency and reliability of data collection. The new sound card is a Santa Cruz (Turtle Beach). System performance cannot be guaranteed with sound cards other than those supplied by or recommended by the company. **You will need to uninstall your current sound card (both the hardware and software) and install the Santa Cruz sound card and software.** You may require technical support to uninstall the current sound card hardware/software. If you do not have access to technical support and/or do not feel comfortable doing this, Kay technical support can walk you through this process over the phone.

After you have installed the Santa Cruz sound card and, then the software and drivers, you will need to configure it to Line Input, and set the Input gain to Maximum.

Inserting the Sound Card into the Computer

1. Turn off the computer and disconnect the computer from the power source.

2. Remove the computer covers to access the motherboard and rear of the computer. You may need to reference the operating manuals for your computer because each computer manufacturer has different methods for removing the covers.

3. Remove other plug-in sound devices, if possible, from the computer. Uninstall the software for this device. You may need to consult with the documentation for the other plug-in sound device to make sure that the software is uninstalled.

4. You may need to remove one of the covers for the rear slot at the selected PCI slot. Insert the Santa Cruz sound card into an available PCI slot by aligning the Santa Cruz gold-edged connector with the selected PCI expansion slot socket. See figure on next page for illustration. With a gentle back-and-forward rocking motion, press the Santa Cruz firmly into the slot until it snaps in place. Note that motherboards with five or more PCI slots will have two or more slots that share the same IRQ (Interrupt Request Line). Please be sure to install the Santa Cruz in a PCI slot that has its own, unshared IRQ. If you find that your computer locks up after you have installed the Santa Cruz, move the Santa Cruz card to a different, unshared PCI slot.

NOTE: Read the warranty information included with your PC before you open its case to remove old sound card and/or install the Santa Cruz. You may need to consult the documentation for the motherboard to locate the unshared PCI expansion slots.

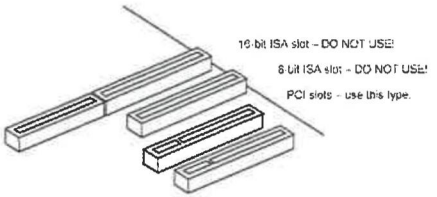

Figure A.1a: This is a sketch of the different type of card slots commonly found in PC. The Santa Cruz card uses a PCI slot.

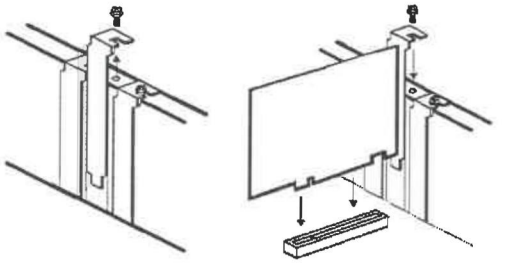

Figure A.1b: This is a sketch of the bracket being removed and the Santa Cruz card being inserted.

1. Connect, if needed for your system, the audio cable from your CD-ROM or DVD-ROM to the sound card. This cable allows audio from the CD ROM or DVD-ROM to be sent directly to the sound card. See figure below.

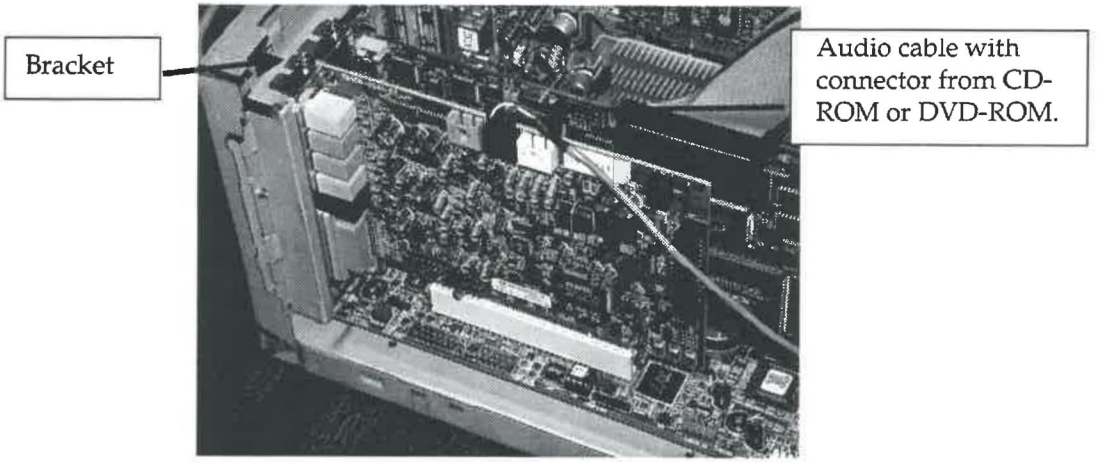

Figure A.2: Picture of Santa Cruz card plugged into the computer with audio cable attached and bracket fastened.

2. Fasten the Santa Cruz card to the back support bracket on the PC.

3. Reinstall the computer covers.

4. Connect the cable from the Nasometer II to the Santa Cruz card (i.e., Line Input, with blue color connector). Note the allocation of cables to oral and nasal channels. See figures. If you are using a microphone for other applications, attach the microphone to the microphone input (the red connector, above the line input).

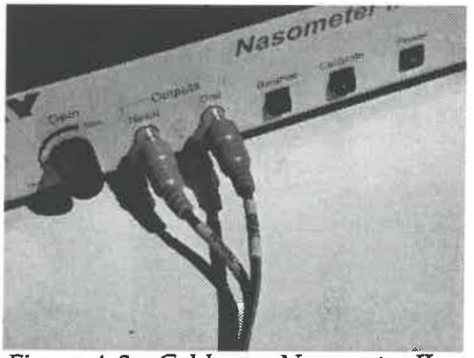

Figure A.3a: Cables on Nasometer II external module.

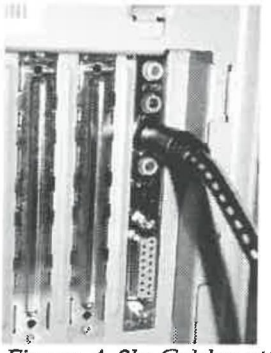

Figure A.3b: Cables attached to blue connector on the Santa Cruz card.

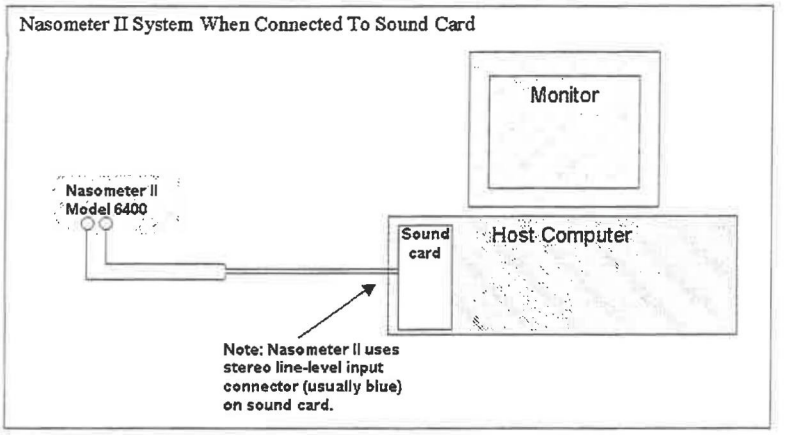

Figure A.3c: This is an illustration of the connection between the Nasometer II and the Santa Cruz sound card.

5. Connect your powered speakers to the Santa Cruz card. Connect to the front speaker connector (Front Out with lime green connector).

6. Proceed to next section to install the Santa Cruz software and drivers.

Installing the Santa Cruz Software Drivers

Software drivers are needed to use the Santa Cruz card. These are installed after the Santa Cruz card has been installed. The step-by-step procedures are as follows:

1. After the Santa Cruz card has been installed (see previous section), connect the power to the computer and turn the computer on.

2. When Windows has booted, it will evoke the Add New Hardware Wizard or the system will report "New Hardware found: PCI Multimedia Device" and prompt for the location of the necessary files on the CD-ROM. **Click Cancel to end this process. You must click Cancel at this screen to properly install the Santa Cruz drivers and software.**

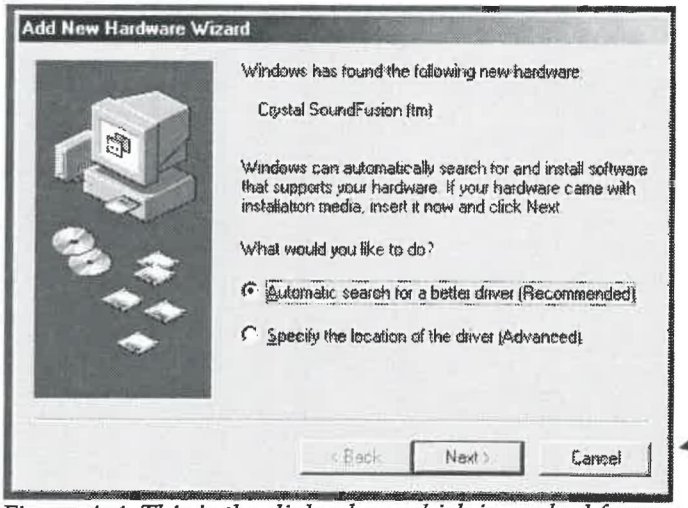
Add New Hardware Wizard
Windows has found the following new hardware:
Crystal SoundFusion (tm)
Windows can automatically search for and install software that supports your hardware. If your hardware came with installation media, insert it now and click Next.
What would you like to do?
Automatic search for a better driver (Recommended)
Specify the location of the driver (Advanced)
< Back
Next >
Cancel
Make sure to click **Cancel.**

*Figure A.4: This is the dialog box which is evoked from WindowsXP when the system is turned on. This dialog box may appear differently on your system. Click **Cancel**.*

3. Insert the Turtle Beach/Santa Cruz CD-ROM.

4. In some computers the Santa Cruz CD will launch automatically only if the auto-insert notification option is enabled for your CD-ROM drive. If the installation menu does not appear after inserting the CD-ROM, use Windows Explorer to select the install application from the CD-ROM driver.

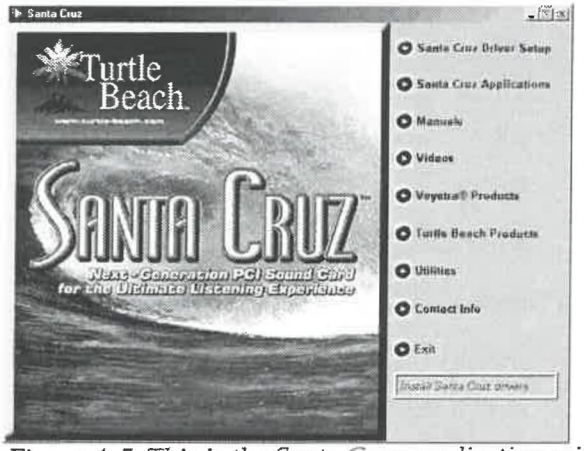

Figure A.5: This is the Santa Cruz application with the Santa Cruz Driver Setup highlighted.

5. Select the Santa Cruz Driver Setup on the menu.

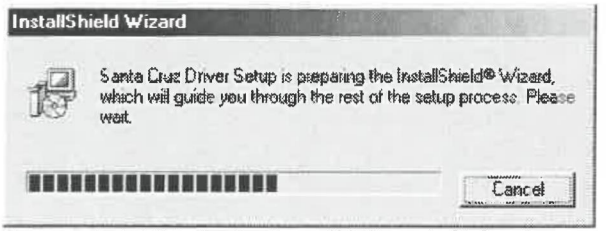
InstallShield Wizard
Santa Cruz Driver Setup is preparing the InstallShield® Wizard, which will guide you through the rest of the setup process. Please wait.
Cancel

Figure A.6: This is the Install Wizard dialog box.

6. Click Next when the Welcome to the InstallShield Wizard for Santa Cruz appears.

Santa Cruz Driver Setup
Welcome to the InstallShield Wizard for Santa Cruz
The InstallShield® Wizard will install Santa Cruz on your computer. To continue, click Next.
Next >
Cancel

Figure A.7: This is the Install Wizard dialog box.

7. Click Next for the Santa Cruz setup Welcome dialog box, agree to the license agreement, select next at the Program File and Setup Type 2 speaker dialog box. If you get a message stating "If Prompted..." (see below), you will need to point to the correct path.

If prompted for the location of driver files by the New Hardware Wizard, please browse to 'C:\Program Files\Turtle Beach\Santa Cruz\Drivers\WDM'

Figure A.8: This is the Install Wizard dialog box.

8. Select the correct path to find the file **cwc3d.osp**, using the Browse button as shown below.

Incorrect Default Folder Location:

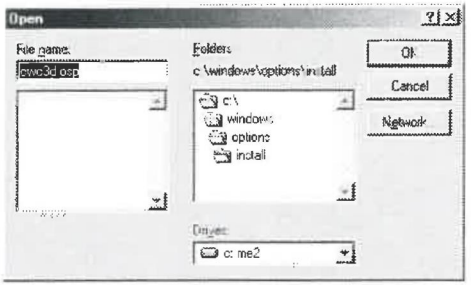

Figure A.9a: This is the incorrect path.

Corrected Folder Location:

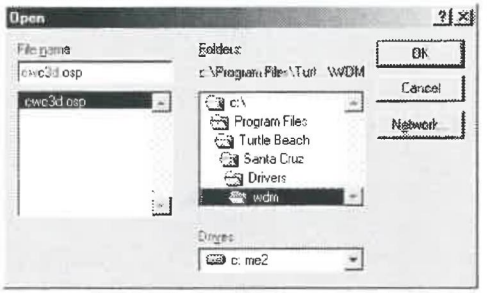

Figure A.9b: This is the correct the path.

Once located, the proper files will be loaded.

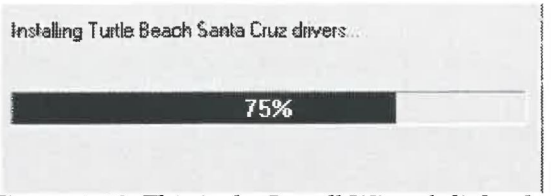

Figure A.10: This is the Install Wizard dialog box informing you that the drivers are being installed.

9. After the installation is complete, you will need to adjust the settings of the sound card. To do this, double click on the speaker icon.

Figure A.11: This is the speaker icon as it appears on the desktop. This can vary in appearance and location depending on windows settings.

10. Adjust the input to line input and adjust the input level to full scale.

Default Incorrect Settings:

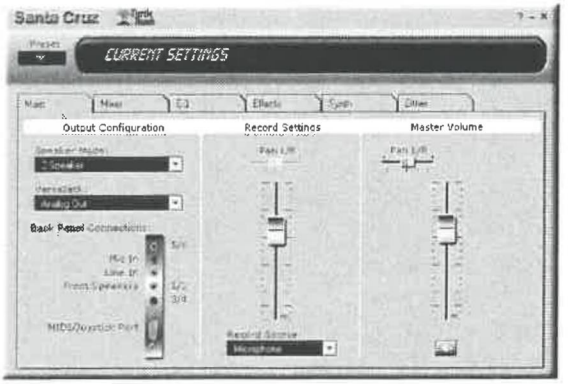

Figure A.12a: Santa Cruz application at the default settings with the record source set to microphone and the record level only part way up the scale. ***This is not the correct setting for the Nasometer II.***

Corrected Settings:

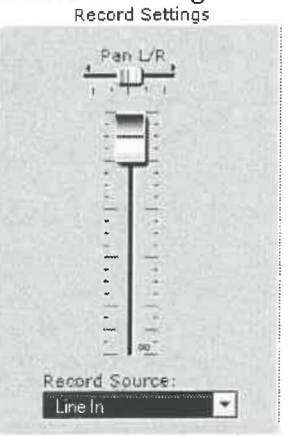

Figure A.12b: This is a portion of the Santa Cruz application showing the correct settings for Nasometer II (that is, after the sources have been changed to Line In and the Record level has been set to the top).

11. You are now ready to install the Nasometer II software.

Installing the Nasometer II Software

Introduction

The Nasometer II software installation program is delivered on a CD-ROM. If you purchased the host computer from Kay with the Nasometer II, the software would have been installed on this system and you do not need to install the application software.

NOTE: If you are installing, or updating, the Nasometer II software in a computer with older versions (<version 2.5) of CSL, Multi-Speech, Sona-Speech, or Visi-Pitch III software, you must update the software for these programs. Consult with factory to get updated software for these programs at no charge. The Nasometer II will cause older versions of these software programs to not operate. The version number can be found in the program (CSL core program, Multi-Speech or any of the program modules in Visi-Pitch III or Sona-Speech) under the Help menu and then About.

Installation Procedure for Nasometer II Application Software

1. For easiest operation of the Nasometer II program, you should first set your computer display to the best resolution for Nasometer II operation. This screen resolution setting is 1024x768. To do this, use the **Start** menu to select **Settings**, then **Control Panel**, and then **Display**. Then, click on the **Setting** tab. The dialog box should appear as in the figure below.

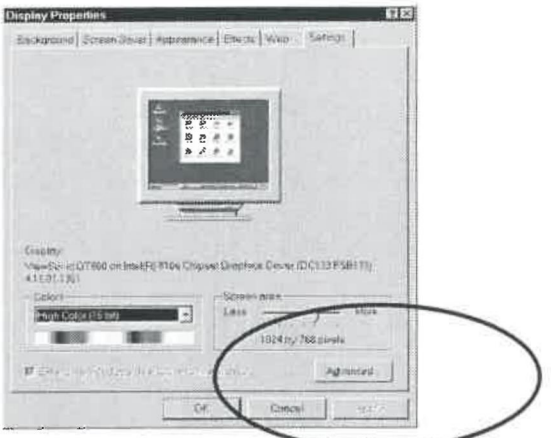

Figure A.13: This is the dialog box for viewing and changing the Display settings. Note that the screen area is correctly set to 1024x768.

2. Make sure that the screen area is set to 1024x768. While the Nasometer II application can operate in other resolutions, this resolution provides the best view of all of the windows used while operating the application. With less resolution, you may need to use the scroll bars in the Nasometer II application to see all of the windows of interest. Click **Apply** to implement new settings, or **OK**, if setting is already at 1024x768.

3. Write down the serial number from the Nasometer II CD-ROM on a piece of paper. You will need the number during the installation process.

4. Plug the HASP key into parallel port. If a printer was using the port, place the HASP key between the host computer port and the printer cable. The HASP key does not interfere with the operation of the printer. If you are using the Nasometer II with a other Kay products which include a HASP key, there will already be a HASP key in the parallel port and a new one does not need to be installed.

5. Insert the Nasometer II software CD-ROM in the CD-ROM drive. Allow 30 seconds for the CD-ROM drive to spin up to speed.

6. Use **Microsoft Explorer** to go to the CD-ROM drive. Double click on **Setup** application (i.e., Setup.exe) icon.

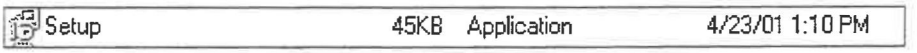

Figure A.14: This is how the Setup application can appear, depending on other Windows View settings.

7. Follow screen prompts to install Nasometer II application software. Click on **Next**.

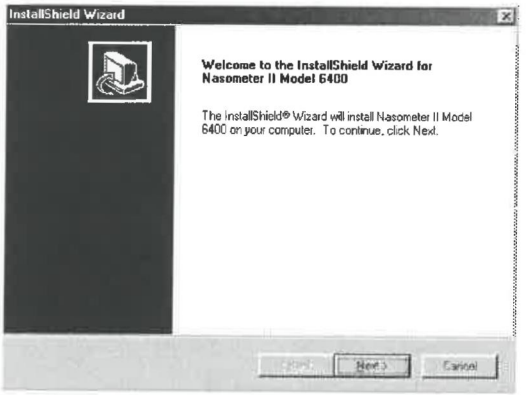
InstallShield Wizard
Welcome to the InstallShield Wizard for Nasometer II Model 6400
The InstallShield® Wizard will install Nasometer II Model 6400 on your computer. To continue, click Next.
Next
Cancel

Figure A.15: This is the first screen of the Nasometer II installation program.

8. Click on **Next** and then **Yes** to agree to the licensing agreement when the next dialog box is presented.

9. Enter the user name, facility, and serial number information. The serial number is on the CD-ROM.

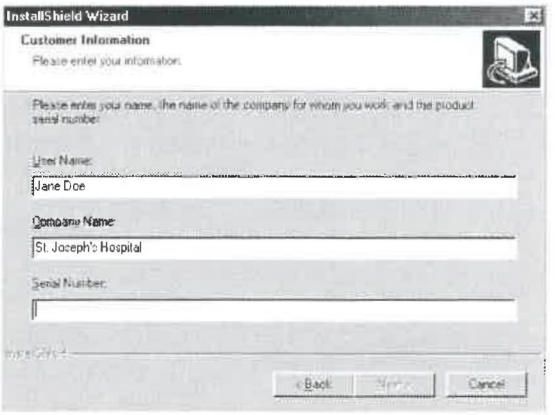

Figure A.16: This is the dialog box to enter user name, facility name, and the software number from the Nasometer II CD-ROM.

10. Once all information is entered, the Nasometer II software is installed.

Appendix B - Maintenance Recommendations

Kay recommends that the Nasometer headset be returned once per year to assure that microphone frequency response and sensitivity are still within specification. In year one, this service is provided at no charge. In subsequent years, a nominal fee will be charged. Shipping costs and proper packing are the responsibility of the customer. An RMA number should be obtained from the service department before returning a headset for inspection (e-mail to: service@kayelemetrics.com to obtain an RMA number or send FAX to 973-628-6363).

Appendix C – Adjustment to Nasometer II External Module

Introduction

Nasometer II systems, which were shipped before March 2003, need a change in the external module (i.e., two internal switches are flipped). This change was made to enhance repeatability and obtain the greatest speech dynamic range possible at one preamp setting (i.e., the second from bottom notch setting on the hardware preamp). The internal switch in the Nasometer II hardware enables an additional analog filter for the input speech channels. This change takes about five minutes. Enabling this filter will cause the speech playback to have lower fidelity, but the Nasometric scores have been found to be more stable using the filtered input signal. To compare your data to the normative data published in this manual, you will need to make this hardware switch (in addition to having software 2.6 or higher installed).

To make this change, proceed as follows:

1. Unplug the power supply to the Nasometer II external hardware module.

2. Using a Philips head screw driver, unscrew the four inset screws on the bottom of the preamp and remove the top.

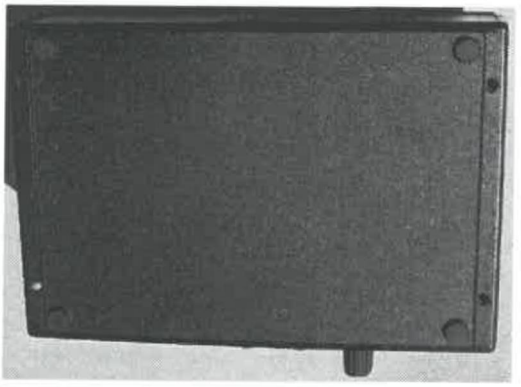

Figure C.1: This is the underside of the Nasometer II, Model 6400, external module. Note four screws for disassembling the unit.

3. Change switch settings to Filter ON setting (see diagram).

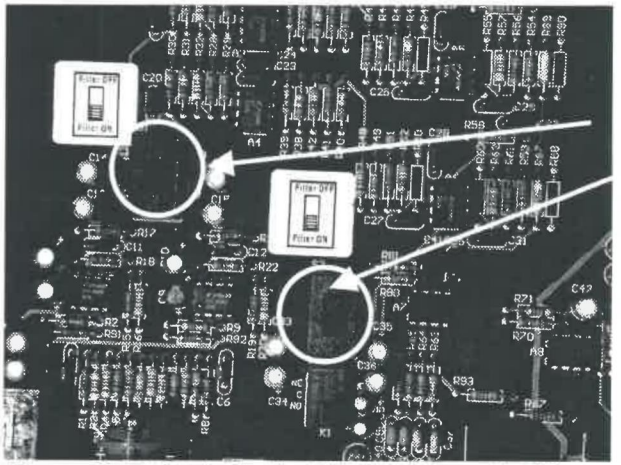

Figure C.2: This is the inside circuit board of the Nasometer II, Model 6400, external module. Note the two switches that should be switched to the Filter ON position.

4. Reassemble the box using the four Philips head screws.

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